THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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CLEVELAND, O., MAY 23, 1889.

THE WEEK IN IRON CIRCLES.

General Features. The event of the week was the official announcement, on Tuesday, that, beginning May 28, the rate on iron ore from lake ports to Pittsburgh would be reduced from $1.25 to $1.05, and to the Mahoning Valley from 75 to 62½ cents. This is the result of the struggle on the part of Pittsburgh iron manufacturers to regain their supremacy as against the active competition of Southern irons, and is generally regarded as very significant. In order to put Cleveland manufacturers on an equal basis, a reduction in coke rates may follow. In the meantime, iron ore is going forward from the mines very rapidly, the shipments by lake having last week reached a figure over half a million tons in excess of the amount reported at the corresponding date last year. The "dead calm" still prevails in the leading iron centers. At Chicago there are numerous signs that the heavy buying that usually occurs in that market will begin earlier than usual. Prices have descended to such unheard-of depths that the larger buyers begin to think that further delays may be dangerous. Each one expresses his intention to stock up largely before the turn comes, and it is apparent that when all agree that the right time has arrived, there will be an activity that will affect prices. Anticipating this, some consumers are now quietly providing for their future wants. Pure softeners are likely to become scarce, as no furnace can make them at prevailing prices. A pretty good run of orders is reported for the week at Cincinnati, and there are a good many inquiries in the market. Still there cannot be said to be any general buying, and prices show no sign of improvement. Melters of iron, accustomed to find each month's prices lower than the preceding, are afraid to buy more than actually needed for current use. Until recently furnaces have been so confident of better times near at hand, that production has kept up to the full limit. But for the past month there has been a steady decline in active furnaces. Two or three have blown in, in the South, but a larger number have blown out or been banked for repairs. Crops in the Ohio Valley are greatly improved by the recent rains, and there is a better feeling in consequence. Business at Detroit has been dull during the past week, and while there have been inquiries for a fair amount of coke and Lake Superior charcoal iron, the sales have not been as large as usual at this time of the year. Notwithstanding the dullness, very few furnaces desire to contract for deliveries very far ahead unless at higher prices than at present ruling. Different views are expressed by Louisville consumers in regard to the course the market will take. Some hold that the conditions are such that a strong advance may take place during the year; others feel that the large number of furnaces, the accumulation of iron, and the fact that so far there has not been a general movement to shut down, will necessitate extremely low prices for several months, and their fears are that iron will go even lower. As predicted in last week's report from St. Louis, inquiries on larger lots are coming in. Buyers are awakening to the fact that prices are extremely low and that the present is a good time to cover future wants. In spite of the increased inquiry, a few furnaces have made lower quotations than were current two weeks ago. Several of the large Southern furnaces are so far sold ahead that they are practically out of the market. As soon as two or three of those, that are forced to sell, fill their order books, it is probable there will be a stiffening of prices. Quotations are reduced about 25 cents to correspond with the actual state of the market. There is no improvement yet visible in the Pittsburgh market. Makers of iron show more anxiety to dispose of their surplus stock than buyers do to take it up, and the natural consequence is a weak and lifeless market.

Iron Ore. While the activity of the market thus far has indicated a considerable excess of sales over the corresponding portion of the '88 season, there has been noticed, during the past few days, a falling off which, although but the natural sequence of the general depression of the iron trade, has been none the less severely felt by the producers of iron ore. Non-Bessemers, which have hitherto sold freely and at an advance over last year's prices, have not been in the market during the past week to any appreciable extent. The dealers account for this with the claim that they have sold all they wish to dispose of at the present rates, while the consumers say that they are in no position to purchase ores, on account of the very large pig iron stocks they now carry and, also, because of the extremely low price of their finished product. Bessemer ores are practically out of the market, but here the conditions are reversed. The holders insist upon what they consider a living profit, while the consumers claim that with the present prices of their steel product they cannot buy ore at the quoted rates and live. This view seems to be borne out rather by the ruling market prices, which quote muck bar at $26.50, while steel rails bring but $26. No one imagines that this curious state of affairs will last any length of time, but for the present it acts as a check upon trade, and is an important factor in the lack of sales. A sale of ten thousand tons of Wetmore at $3.50 for a Valley furnace is pending, but at this writing was not concluded. It is reported that some rich non-Bessemer ores, like the Buffalo and Queen, which a month ago brought $4.25, are now offered below $4. Mr. Carnegie is said to have determined to purchase no more ore at present, owing to the contemplated strike at his works, but will, it is reported, purchase 300,000 tons later on. Norrie has sold over half a million tons for '89 delivery. Republic reports some sales, but the total amount is not stated.

Pig Iron. Nothing has occurred in the way of a change, and pig iron prices are as low as ever. Quotations range from $15 for No. 1 foundry to $13 for mill iron, and the sales are next to nothing. While it is true, however, that these quotations are abnormally low and out of all proportion to the cost of manufacture, it is also true that the prices here quoted will hold only for smaller lots and for spot delivery. Buyers would be unable to purchase at these figures large lots for the present, much less for future delivery. Furnacemen everywhere are complaining of the inroads made upon the market by Southern iron, which is largely bought for foundry purposes in connection with American Scotch. A few years ago foundry men declined to use any but lake irons, but having discovered that with an admixture of Southern iron with American Scotch they can produce a fair quality of castings, they are availing themselves of this opportunity, the proportion being about three tons of, say Alabama iron, which may be purchased and delivered here at $13.25, with one ton of American Scotch at $16.25. Still the furnacemen are hoping for better times, and predict a change for the better within the next sixty days.

Merchant Iron. Bar iron is moving quietly, the price remaining $30 net at the mill, or $32 out of store. Sheets are only holding their own, the demand being light. Combination shapes are in active demand, the smaller grades of channels leading.

Scrap Iron. Dealers ask $21.50 for old American rails, but the volume of sales is quite small. Turnings go at $12.75, other items being out of demand, except axles, which command $23.

Hardware. Nothing can be reported in addition to the general statement that the trade is in a flourishing condition, and that the boom is still "on."

PIG IRON SPECULATION ONCE MORE.

Just eighteen out of the *Age of Steel's* eighty-eight lines of reply to THE IRON TRADE REVIEW'S recent remarks on pig iron storage are devoted to a discussion of the one essential objection to the scheme. Here they are:

But our good friend of THE IRON TRADE REVIEW will contend that we are not telling him what the *Age of Steel* thinks about the question of speculation in connection with the proposed scheme. To fully answer the REVIEW would involve both of us in a never-ending and unprofitable discussion as to the benefits and disadvantages of speculation in business. It is enough to say that if the speculative feature, in all kinds of business, was eliminated, there would be very little for any of us to do in this world of ours. Speculation may be a very undesirable thing in an ideal state, but so long as trade is conducted on its present basis business men will just as surely back up their views of the future by buying or selling, as they will eat and sleep. But all this has nothing to do, directly, with the scheme. The warrant company cannot buy or sell pig iron or pig iron warrants, while the furnaceman will use his own pleasure, as he does now, about speculating in his product.

We must still insist upon admiring our St. Louis contemporary's skill in evading the main issue. Concerning the storage features of the scheme we have said little, if anything. The good faith of the Southern furnacemen who have gone into it we have never questioned. Nor could we, with good reason, criticise it if the matter of speculation were a mere incidental accompaniment of it. What we do contend—and what we have, we believe, given ample evidence of—is that the scheme, in its essence and design, is very largely speculative; that its chief promotors are widely known by reason of their connection with the science of manipulating stocks in other fields, and that, shorn of its speculative possibilities, the thing never could have been floated at all. The evidence adduced from abroad has not related to what British iron and steel authorities have to say concerning the American project, but what they have said concerning the evils of their own Scotch warrant scheme. We do not know, nor do we care, whether British iron masters are opposed to the American scheme or not. We only know that the British iron trade has tried the idea and condemns it—condemns it chiefly upon the ground that the accumulated stocks have been made the play of unscrupulous speculators. That is Great Britain's experience on the line of pig iron speculation. We may learn wisdom from it, or we may not. The *Age of Steel* prefers that we should try the more convincing test of burnt fingers, before admitting the calorific properties of fire. We prefer the old fashioned plan of keeping the fingers out altogether, and drawing conclusions from the seared finger tips of others.

NOTES FROM THE SEAT OF WAR.

The Southern trade papers and writers have taken up the discussion of the so-called "Thomas pig iron war" with a vim. If the recent cut of the Thomas Iron Company has not carried consternation to the Southern iron trade, it has, at least, brought out a volley of vigorous protests. Quoting a recent interview with Mr. B. C. Clarke, of New York, President of the Thomas Iron Company, in which that gentleman affirmed that Southern operators had built more furnaces than they had capital to work properly, and that they could not make living profits at the prices which they were now getting, the Chattanooga *Tradesman* remarks:

The gentleman assumes too much when he consoles himself with the notion that the Southern furnaces he is competing with are weak in capital and must "shove their iron on the market, and take what they can get for it." In point of fact his chief Southern competitor, the Tennessee Coal, Iron & Railway Co., is stronger financially than the Thomas Co. The latter has capacity of about 200,000 net tons per year, while its Southern competitor has capacity of more than 300,000, and will by the end of this year be able to make 400,000 tons. That company is now producing iron from its Alabama stacks at a cost of $9 a ton. Freight and commissions to and in the Eastern market are $4.25; cost of iron laid down in New York or Philadelphia, $13.25 per ton; average selling rate net $15 for both brands; profit $1.75. There is not a great margin, but it is as much as the Thomas Co. can realize. Their iron costs $14; freight, 75 cents; total cost in New York or other tidewater points, $14.75; rate on No. 1, $16.50; profit $1.75. They may possibly realize $2 on No. 1, and that would make their average profit about $1.50 a ton. The battle is not so unequal as Mr. Clarke is pleased to think.

The *Tradesman* is not of the opinion that this "speck of war" will amount to much, claiming that the Thomas Company's cut relates only to customers who had placed orders with it for 180,000 tons for the year, and who were not taking it fast enough to please Mr. Clarke.

The *Age of Steel* (St. Louis) takes this philosophical view of the situation:

The condition of affairs here indicated is unfortunate, to be sure, but it is, after all, simply the logical outcome of the development of Southern iron manufacture. A half a decade ago it became apparent that the encroachments of Southern iron upon the important preserves of Eastern Pennsylvania furnacemen would, in the long period required to determine the question of survival, be marked by desperate struggles at times. Such was the history of the efforts of the New England iron industry to live in the face of the pushing competition from Pennsylvania; and while, undoubtedly, it would be folly to expect the South to make pig iron manufacture impossible in the territory in question, yet there is "manifest destiny" in trade as well as in politics, and it is altogether problematical as to what extent the industries involved may be preserved. For the contest is not of a day or a year, to be decided by the longest purse of the oldest man now living; if that were the case, the Southern iron masters would very likely be worsted. True, the latter can make much the cheaper iron; but distance is a disadvantage to them in shipping to Northern markets, and, besides, Southern furnace companies at present are not any too strongly equipped, financially, for the supreme test of low prices.

Still another Southern trade paper, the Baltimore *Manufacturers' Record*, assumes this belligerent attitude:

The *Manufacturers' Record* knows that many furnaces in the South can make pig iron at a profit, even if prices go a little lower than at present. This is not guessing. We know whereof we speak. The Southern iron trade will come out of this fight in such good shape as to command universal attention, and the result will be a greater boom than ever for the South. There may be a few badly located furnaces in the South, that cannot make iron at a profit at present prices, but the most noted Southern furnaces will push right along, turning out as much iron as possible, and on it they will make at least a living profit. When the inevitable reaction to high prices does come, the South will boom as never before.

And these interesting facts are brought out in a letter from Birmingham, Ala., to the *Record*:

Under the gradual reduction of expenses that has been going on with the furnaces for the past two or three years, and a gradually increased output and better grades, there is not a stack in the South but what is making iron at not over $10 per ton, and many of them as low as $8.50. At least four-fifths of the output can be, and, in fact, is being, used for foundry purposes. The cost of freight to the New York and Philadelphia markets is $3.75 per ton, or say cost of putting it down in what is considered the cheapest market they have, $13.75 per ton, at which price they can get a new dollar for an old one, and who is there that will say that pig iron will ever be sold in those markets at such a price?

Summarized, the situation seems to be about this:

President Clarke—"There, you Southern fellows, take that and put it in your pipes!"

The Southern Fellows—"All right, Mr. Clarke. Come again!"

CANADA'S IRON PRODUCTION IN 1888.

From advance sheets of the annual report of Mr. E. Costa, in charge of the Mineral Statistics Division of the Geological Survey of Canada, we condense the following statement regarding the iron and steel production of the Dominion for 1888:

	Tons (2,000 lbs.)	Value.
Iron ore	44,410	$ 139,393
Pig iron	18,191	226,443
Rolled and forged iron	40,962	1,442,974
Steel	9,508	470,819

The production of iron ore has fallen off of recent years, we understand, on account of the presence of sulphur in the ore, rendering it, in a measure, unmarketable. This is particularly true of the Coe Hill mines, owned largely by Americans. The statement as to the production of rolled and forged iron includes four rolling mills, one forge and the Londonderry Iron Works. Returns have not yet been received from six similar works, thus rendering the statement very incomplete. The total manufactures of iron will, however, be much larger than those of last year. As a whole, the showing is not good for a country of the size and resources of Canada, and shows either that her raw material is not what has heretofore been claimed for it, or that the wrong policy has been pursued in the past to encourage the development of her underground wealth, so far as iron is concerned.

Taking the mineral production of Canada as a whole, the showing is better. Nominally, the value of all Canadian mineral products for 1888 was $16,500,000, as against $12,959,073 in 1887, but, in reality, $1,847,102 of this increase is a miscellaneous item not included in last year's returns. The mineral museum at Ottawa shows care and diligence of a high degree in collecting specimens of the many valuable minerals to be found in Canada, but the country itself does not seem to have developed sufficient capital or enterprise to avail itself of these manifold advantages.

THE proprietor of a broom factory in Duluth settled a strike by increasing the wages of all his married employes and gave the single men notice that they would not be wanted after the end of the month unless they were married by that time, in which event they would be retained at increased pay. A very philosophical solution of the difficulty, worthy a manufacturer of the principal household weapon of offense and defense.

THE firing of the main guns of war ships by electrical circuits was advocated by Ex-Commander Dana Greene, at the Annapolis Academy the other evening.

DISTRIBUTION OF POWER BY ELECTRICITY.

PROGRESSIVE AGE.

One of the ablest modern writers on industrial questions, says Mr. F. L. Pope in a letter from which an exchange prints extracts, lays down the proposition that the limitations of the advantages derived from the use of any form of force for industrial purposes are fixed by the possibility of distributing the power cheaply and economically, and, furthermore, that of the two factors, the power to distribute cheaply is of far greater importance than the power to produce cheaply. In illustration of this proposition, consider the cheapest source of energy now known, namely, the power of falling water. It has not been found possible to effect the distribution of this form of power, except over very limited areas, from which it follows that all the industrial benefits derived from water power have necessarily been concentrated in the immediate vicinity of the point of its origin, and, hence, when such places have been conveniently situated in other respects, they have acquired great industrial and commercial importance. Such instances may be found at Lowell, Lawrence, Fall River, Holyoke, etc.

On the other hand, there are instances of very extensive and valuable water powers which cannot commercially be utilized, by reason of their geographical or topographical situation, such, for example, as the water power at Falls Village, Conn., one of the finest in New England, which is practically unavailable because there is not level ground enough in the vicinity to afford sites for the necessary factory buildings, tenements and adjuncts.

Scattered all over New England, and, in fact, most of the Atlantic States, are innumerable mill sites of from 50 to 1,000 horse-power, many of which were improved in former days, but which are now lying idle and contributing nothing to the industrial wealth of the community, by reason of their remoteness from more modern facilities of transportation and other inconveniences of their situation. Every horse-power of energy thus running to waste would be worth to the community from $50 to $100 per year, were it so situated as to be utilized to the best advantage.

It is manifestly an important part of the mission of modern electrical development to render all this waste power one more available for industrial purposes. Every increase in the limits of the economical distribution of power increases the opportunity for employment, adds to the ease, convenience and comfort with which the artisan accomplishes his work, and enlarges the surplus wealth of the community.

The two countries which have made by far the greatest advances in the utilization and distribution of electric power, are Switzerland and the United States. It is well known that Switzerland is disadvantageously situated as a manufacturing country, for the reason that, although it is supplied with an almost unlimited number of the finest water powers in the world, situated upon unfailing streams fed by the melting of Alpine snows, yet these are situated, in almost every instance, in inaccessible valleys and ravines where economical transportation of heavy products is impossible. The railroad lines are situated in the main valleys at too great a distance from the water powers, in the majority of cases, to render them of much value. Steam power, on the other hand, is expensive, as there are no coal mines in the republic, and the coal used must be brought many hundred miles and up heavy grades, which render it so costly that the Swiss manufacturers have been unable to compete successfully with those more favorably situated in countries in closer proximity to the iron and coal districts. The manufacturers of Switzerland have, for this reason, heretofore been confined to the lighter and more delicate varieties of machinery, in which the cost of labor is the principal element and the cost of transportation an inconsiderable one.

The recent introduction of methods of transporting and distributing power by electricity is rapidly changing this state of affairs, and in a few years it is probable that Switzerland will become one of the foremost manufacturing countries of Europe in all those varieties of industries in which cheap power is an important element, such as the manufacture of steam engines, stationary and locomotive, and heavy machinery, of paper, cotton and woolen goods, and the like.

In the ancient city of Solothurn, in the northwestern part of Switzerland, there is a manufactory of machine screws which is driven by an electric motor of 50 horse-power, which derives its energy from a turbine wheel which is situated on a mountain stream at a distance of over five miles from the works. The electric current is conveyed upon wires not larger than an ordinary lead pencil, suspended upon poles on the public highway. No one would notice any difference between this line and the ordinary telegraph line, and, in fact, there is no difference, except that the construction is rather more substantial and the insulation more carefully attended to. The proprietor of this factory informed Mr. Pope that his electric motor had been running eleven hours a day for over two years, and had never been out of order for a moment, and had required no repairs. He could not say too much in its praise.

The same gentleman also visited a delaine mill at Derendingen, Switzerland, of 36,000 spindles, and the necessary complement of other machinery. This factory was driven by a pair of electric motors of 280 horse-power, deriving their energy from a turbine wheel situated about one and one-half miles from the factory, the connection being made by a line of insulated copper wire, similar to the one at Solothurn. The manager of this factory told exactly the same story. He had never had any trouble whatever with the motors that had been running for a year, without repairs, and appeared likely to run for an indefinite length of time. He considered it far superior to any other form of power, especially in the manufacture of the delicate white woolen goods, in which the absence of the smoke, cinders, and dirt from a steam engine was a particularly desirable condition. This is also the case in paper-making and other industries of like character. The cost of this electric installation at Derendingen, including the electric generators, electric motors and connecting conductors, was about $15,000 of our money, or about $54 per effective horse-power. The cost of attendants, repairs and maintenance is trifling.

There are several other instances of electric power transmission in Switzerland. One of these, at Lucerne, carries 120 horse power half a mile, and another 250 horse-power a quarter of a mile. From what Mr. Pope saw, it was quite clear that there could be no possible difficulty in conveying even 1,000 horse-power at least a distance of five miles, and there is no reason to suppose that this distance is anywhere near the possible limit which may be attained.

The installations described were put in by the Oerliken Machine Co., whose works are near Zurich, and employ about 800 men. The visitor was informed that, in consequence of the success of the plants at Solothurn and elsewhere, their books were crowded with orders, and, especially, that they had received an order from Northern Italy for a much larger plant than any which had yet been erected.

We have no examples in the United States of anything like this amount of power, being transmitted and utilized by a single motor. The writer says he does not know of any motor which has yet been set up of over 60 horse-power. The development of power transmission in the United States has been mainly in the direction of distribution from a common source of energy to many small motors. Recent returns afford a basis for an approximate estimate that there are as many as 6,000 electric motors to-day in use in the United States for industrial purposes. They have a capacity varying from the small one-sixteenth horse-power which is used to drive a family sewing machine, up to the 50 and 60 horse-power motors employed in mining and milling works. One of the most common and favorite sizes is 10 horse-power, of which large numbers are in use in New York, Boston, Baltimore, Rochester and many other places.

Every manufactory of motors in the United States is crowded to its utmost capacity in its efforts to meet the constantly increasing demands for electric power. Mr. Pope thinks it is, apparently, only a question of time, and not a very long time either, when it will be difficult to find in any city a steam engine of less than 50 horse-power capacity. The demand for smaller powers being met so much more conveniently, economically and satisfactorily by the electric motor.

EDGE TOOLS MADE FROM PIG IRON.

ANNISTON (ALA.) HOT BLAST.

There is in Anniston to-day the representative of a new industry which promises to work wonders in the manufacture and cost of edge tools. By this process a bar of high grade pig iron is converted into an edge tool that is warranted to stand the severest test, and come out of it keen and ready for another conflict. The gentleman is Mr. Fred R. Levering, and the industry he represents is the Falls City Malleable Iron & Steel Works, located at Louisville. While Capt. T. G. Garrett was in Louisville his attention was attracted to the new and promising industry, and upon inquiry learned that it was possible to secure its advantages to Anniston. He set to work at once to arrange for bringing the subject before our people, and, as a result, the company agreed to send Mr. Levering down to consult with Anniston's enterprising men, and show them just what the tools made by the company will do when put to the wood.

Yesterday afternoon Mr. Levering and a party of some twenty gentlemen went to the Rolling Stock Works to apply the test. An axe, an adz, and a hatchet of his casting, just as they came from the cupola, were given to one of the blacksmiths who drew them to an edge, and tempered and ground them. Handles were then attached, and one of the hardest and knottiest pieces of seasoned oak that could be obtained was arranged where all could see the test. Each implement was tried by different persons, and none of them seemed to spare their strength, but when they had finished no tool was perceptibly dulled. A niche was knocked out of the center of the adz, and a corner was broken off the axe, but this was done on knots that all agreed would have broken any tool used on such work. To show that the implements were only ordinary castings, Mr. Levering took one of the untempered tools, and broke it in pieces with a hammer.

To manufacture these implements it only requires a good grade of pig iron. The process is patented, and consists of casting in a cupola just the same as a plow point is cast. It then goes into the annealing oven, where it is decarbonized to the proper degree. Afterwards it is tempered as any other tool steel is tempered. Then it is polished and finished up for the market.

The manufacturers and capitalists of the city, who are interested in this movement, will meet Mr. Levering at the office of Roberts & Co. The proposition upon which the plant can be secured to Anniston is, that her citizens take the $250,000 stock of the company at par. Mr. Levering agrees to test a quantity of Woodstock iron at Louisville, and determine if it will answer in the manufacture of edge tools. This test is to be made in the presence of Anniston men, who are to accompany the iron, and see that it, and it alone, is used in the manufacture of the test tools. There seems no reason why Woodstock iron should not prove more valuable for this purpose than that now used by the Falls City people.

The World's Biggest Steel Works.

In the opinion of the *Bulletin* of the American Iron & Steel Association, the Chicago steel consolidation is "the most important event that has ever taken place in the history of the American iron trade. Nor has the world ever seen such an aggregation of capital and machinery in the hands of one manufacturing corporation as is now controlled by this new company. The influence of the consolidation upon the future of our iron and steel industries must be very great, although it may not be immediately manifested. One of the consequences which may follow the consolidation at Chicago, is the adoption of a similar policy by some of our Eastern Bessemer steel companies."

AMONG THE IRON MINES.

Menominee Range:—

The Florence is the third largest shipper among the various Menominee range mines, now leading both the Dunn and Iron River by some three to four thousand tons, her shipments up to Wednesday last aggregating 20,448 tons. The mine is now sending ore forward at the rate of 1,000 tons per day. Put the Florence down for 175,000 this season.

An Ishpeming correspondent says the Dunn will ship 200,000 tons of ore this season. A more reasonable estimate would be 150,000 tons. Even if the Dunn achieves this wonderful record, there will be abundant reason for rejoicing upon the part of the fortunate owners, considering the fact that this is only the third year of the mine's existence.

The work of stripping the Commonwealth goes bravely on. Crooks & Gordon, the contractors, are now working night and day, and expect to complete their big job about the middle of June. Water has bothered them some, but this difficulty has been overcome by putting in two powerful pumps. The pit is growing larger every day.—[Range.

Marquette Range :—

The Palmer & Maas iron prospect, at Humbolt, promises to develop into a big mine. Assays show the one to be a Bessemer running away up in the sixties in metallic iron. The board of water commissioners, of Ishpeming, has decided to get water for the city's use from Lake Salley. Lake Angeline will be pumped out, and the Cleveland, Lake Superior and Lake Angeline Iron Companies will then open mines under the bed of the dried-up lake. The Cleveland company has already made extensive preparations for mining under the lake. The "section sixteen" shaft of the Lake Superior mine will be a heavy producer of ore this season. The shaft is in the Lake Angeline basin and adjoins the workings of the Lake Superior and Lake Angeline iron companies. Promising discoveries are reported from the Riverside mine, at Republic; the East Jackson, at Negaunee, and the East New York, at Ishpeming. The East Jackson is unwatered and mining work will be actively resumed. The capital stock has been increased to 40,000 shares and a controlling interest is held by copper district capitalists. The East New York will be quite a large producer this season. There are two parties figuring on buying a controlling interest in the Riverside. At present the management is hampered by a lack of funds. The Kilworth, Hancock and other explorations and small mines are being worked and may develop into something of value before the season is over. On the Southwestern shore of Lake Michigamme there are several properties having large deposits of ore, some of which have been known of for years, but the district has never been penetrated by a railroad. At present the Duluth, South Shore & Atlantic and Milwaukee & Northern railroads are both within ten or twenty miles of this district, and the building of an extension to the place may be done soon.—[Ishpeming Correspondence.

Joseph Kirkpatrick is exploring for the Pittsburgh & Lake Superior Iron Co. near the Volunteer mine. Ore is known to exist there, and a new mine may be looked for in that district. On the East Negaunee range work is being pushed at the Negaunee, Buffalo, South Buffalo, Boston, Queen and Prince of Wales, all of which will be shippers this season. The combined output will cut quite a figure in the shipments of the Marquette district.

Timothy Hughes, Michael Cassin and other Ishpeming parties have leased a forty-acre tract immediately south of the Negaunee mine, in section 6.47-26, Michigan, and are confident of opening up a mine upon the property. They expect to strike the Negaunee vein, which is believed to extend over the boundary line, and exploratory work will shortly be commenced.—[Mining News.

Mr. B. M. Colwell, of Appleton, Wis., a former resident of Ishpeming, and discoverer of the Beaufort and Titan mines of the Michigamme field, has a valuable tract of land, three miles northwest of the Magnetic mine, he owning, with the exception of one forty, the fee of section 12, town 47, range 31. This he visited during the week, securing several fine samples of both hard and hematite ore, that give evidence of being of good quality. An assay of the hard ore proves it to be a Bessemer. There is every indication there that is looked for by the prospector, the accompanying rocks being of the right kind and in place. No work is at present being done, but a thorough system of exploring will undoubtedly be instituted. We visited the property some time ago, were much pleased with the showing, and look upon it as a very promising one.—[Iron Ore.

At the above mine a promising find in the shape of a new iron ore body has been made by drifting north from the 150-foot level of No. 2 shaft. At 110 feet from the shaft three feet of fine, hard ore was struck, and against which a body of hematite was found. The latter is of excellent quality and has been drifted into for a distance of 25 feet without finding the opposite wall.

Gogebic Range :—

Work on the Mikado mine, east of Bessemer, is to be resumed. Capt. Duncan McVichie will have charge of the development.

The Prince of Wales Mining Co. was organized at Negaunee, on Tuesday. The following officers were chosen: E. D. Anthony, president; J. F. Mack, vice-president; S. P. Kline, secretary and treasurer; Edward Lobb, manager; E. C. Anthony, Edward Lobb, F. D. Davis, S. S. Wood, J. F. Mach and Charles Dahlstrom, directors. The capital stock is $1,000,000, with shares at a par value of $25 each. It is reported there is already a forty-foot vein of ore in sight on the property, which adjoins the Queen mine, and it is the intention of the company to sink a shaft and begin mining ore at once.

Secretary Haselton, of the Metropolitan Iron & Land Co., which operates the Norrie mine, on the Gogebic range, is authority for the statement that that property is likely to ship 500,000 tons of ore during the present year. Last year the Norrie shipped 411,000 tons of ore, by far the largest annual shipment ever made by a single iron mine, and with a total shipment of 500,000 tons will undoubtedly be in the lead again this year. The Chapin, on the Menominee range, is the only other mine in the Lake Superior fields that is the least likely to ship anything like 500,000 tons of ore this season. The Norrie is shipping both from Ashland and Escanaba. Over 60,000 tons have already been shipped by lake since the opening of navigation, and this, added to 30,000 tons previously shipped by rail to Chicago, and the ores in docks, swells the total output of the mine up to date to 100,000 tons. The Norrie's daily shipments run from 3,000 to 4,000 tons. The mine shipped 24,000 tons during four days last week.—[Wisconsin.

At the Palms, No. 3 shaft, which at the time of our last report was still sinking, has reached a depth of about 360 feet, at which point the seventh level was started and drifts along the ore body are now opened up about 250 feet in length, all in ore. On this level the ore varies in width from 15 to 50 feet, and lays on a base of a hard rock of the same general character as the cap-rock of the range, and is capped by the same material. This lens is about 50 feet in thickness and dips to the east. The greater portion of the work is being done west of No. 3 shaft, and by following up this base of jasper-like rock, by the time a point directly underneath No. 4 shaft is reached the shaft will have to be sunk only about 40 feet to connect with this level, on account of the regular inclination of the bed rock. The Palms is looking far better than ever before, and under the management of Capt. Christopher is rapidly proving itself to be a first-class property, and is demonstrating the fact as well that there is ore in good quantities to the east of Bessemer.—[Iron Spirit.

Lake Superior Shipments of Iron Ore:—

Shipments of iron ore from the mines of Lake Superior for the season of 1889, up to Wednesday, May 15th, are as shown by the appended statement, condensed from the Marquette *Mining Journal:*

MARQUETTE RANGE.

American	1,202	Hall	7,492	Prout	1,237
Barnum	918	Humboldt	536	Queen	4,152
Braastad	8,509	Jackson	12,269	Republic	45,813
Buffalo	4,405	Jackson, pit 7	1,366	Republic Reduction Co.	4,102
Buffalo, South	2,205	Lake Superior	1,522	Salisbury	1,811
Cambria	11,562	Lillie	5,695	Salisbury Bessemer	3,229
Champion	34,490	Lucy	965	South Buffalo	4,245
Cleveland	15,589	Marquette	3,187	Superior	5,355
Cleveland, Hematite	5,003	Michigamme	2,795	Superior, Hematite	9,211
Cliffs shaft	17,175	Milwaukee	5,980	Volunteer	2,670
Curry	1,202	Negaunee	9,675	Webster	117
East New York	1,364	Pitts. & L. Angeline	24,275	Winthrop	11,715

Total, Marquette Range 278,272

MENOMINEE RANGE.

Armenia	4,117	Florence	20,448	Monitor	1,301
Chapin	70,419	Great Western	4,729	Norway	13,364
Commonwealth	13,447	Hamilton	1,659	Perkins	593
Crescent	3,236	Iron River	16,002	Vulcan	24,740
Cyclops	5,405	Ludington	9,818		
Dunn	17,078	Mastodon	8,356		

Total, Menominee Range 214,712
Total, Gogebic Range 167,935
Grand Total 660,919

Sale of a Spanish Iron Mine :—

It is rumored that Mr. J. Victoria, of Bilbao, Spain, has sold the Parcochia iron mine, near Somorrstro, to Messrs. Murrietta & Co., of London, for a very large sum of money. The buyers have made a contract to build a railway at once to the River Galindo, and also to dredge the latter, so that they can load ore there.

Our Railroad Relations with Canada.

A committee of the United States Senate has been conducting an investigation in New York touching upon our railroad relations with Canada. The object is to obtain information respecting the amount of commerce originating in the United States and diverted to Canadian lines of transportation, what means are used to this end, and report what legislation is necessary to protect the commercial interests of the United States. American roads are burdened with long and short haul, and other laws, which, it is contended, completely handicap them when brought into competition with lines outside the United States laboring under no such restrictions. Canadian roads hauling goods from points in the United States to Canada come under the jurisdiction of the Interstate Commerce law, and cannot favor or discriminate against either the shipper or consignee. It is in the enforcement of the law that the trouble exists. Commercial non-intercourse would not be a solution of the question, as more Americanss are interested in Canadian roads than Canadian are in American lines of railway. No practical remedy for the situation has yet been suggested, although presidents of a number of roads interested have been examined. The final outcome will probably be that the committee will recommend an enforcement of the workings of the Interstate law as applied to Canadian goods.

Demand for Saw Mill Machinery.

There is a lively demand for saw mill machinery all through the Western and Southern States. In addition to the new mills and machinery there is also a great demand for reconstruction and for improved machinery. Time was—and that not long ago—when the builder of saw mill machinery contented himself with looking after new mill enterprises, and incidental repairs here and there. Of course, there were additions of new machinery, now and then, but no such revolutionary reconstruction as is now going on in a great many mills. The sharp competition in the lumber trade has proven a friend to the machinery maker. The best inventive genius is taxed to keep up with the demand for first-class machinery, and the mill men are showing a commendable disposition everywhere to keep up with the times.

This branch of manufacture has gradually developed from small beginnings, until the best saws in the world are now made in the United States. In this direction American industry has achieved a signal triumph, and while the foreign producer is beaten at every point, a growing important export business has sprung up in American saws of late.—[Mining and Scientific Press.

INDUSTRIAL SUMMARY.

New Enterprises :—

J. D. Kase, of Danville, Pa., will build a 150-ton iron furnace at Athens, Tenn.

The Empire Plow Co., Limited, of Pittsburgh, will doubtless remove its plant from Pittsburgh to Cleveland.

The National Switch & Signal Co., of South Bethlehem, Pa., has been granted a charter with a capital of $50,000.

J. T. Wilder, of Roan Mountain, Tenn., has purchased a site for foundry and machine shops, at Blacksburg, S. C., to cost $50,000.

It is said that a steel plant and nail factory, also a rolling mill with 50 tons daily, will be built by the Fort Payne Rolling Mill Co., of Fort Payne, Ala

The Spring Manufacturing Co. was recently organized at Martinsburg, W. Va., for the purpose of manufacturing wagons and agricultural implements; the capital stock to be $25,000, with the privilege of increasing it to $100,000.

The Continuous Rail Joint Co. of America has been incorporated at Jersey City, N. J., with a capital stock of $100,000 for the manufacture of rail joints and fish-plates. The incorporators are Robert Gray, Jr., Abraham W. Thompson, Fernando C. Runyon and Frederick T. Fearey, all of Newark.

The Virginia, Tennessee & Carolina Iron & Steel Co., incorporated at Goodson, Va., two years ago, have filed a charter at Richmond. The capital. stock is $4,000,000. Offices are to be at Goodson, Pineville, Ky., Cranberry, N. C., and Jersey City, N. J. F. W. Huidekoper, of Washington, D. C., is president.

Illinois incorporations: National Steel & Horseshoe Co., East St. Louis; capital, $1,500,000; for the manufacture of horseshoes; incorporators, William Welles, C. W. Fox and Z. W. Tinker.—Brainard Bolt Co., Chicago; capital, $50,000; to manufacture steel and iron bolts; incorporators, A. M. Brainard, A. C. Webb, W. R. Jermoe, M. J. Enright.

The Hall Mowing Machine Co. has been incorporated at Portland, Me., to manufacture lawn and field mowers under the patents granted George A. Hall. President, Hon. Charles J. Chapman; clerk, Seth L. Larabee; treasurer, Clinton A. Woodbury; superintendent, George A. Hall. Directors: Hon. Charles J. Chapman, George A. Hall, William H. Stevens, C. A. Woodbury, T. B. Percy.

Wm. B. Scaife & Sons and the Scaife Foundry & Machine Co., Limited, of Pittsburgh, have about completed the greater portion of a new Bessemer plant, with a number of new improvements, for Messrs. Miller, Metcalf & Parkin. The buildings, all of iron frame-work, covered with corrugated iron, were designed and erected by the first-named firm, and the various styles of cranes, ladles, converters and hydraulic machinery were designed and built by the latter.

A press dispatch from Green Brier, W. Va., under date of the 12th inst., says: "The Glenmore Iron Co., organized with Gen. J. R. Anderson, of the Tredegar Iron Works, Richmond, as president, will erect a great plant on the Glenmore estate, 3 miles from this place. They have acquired 3,000 acres of land, upon which there is a vein of iron ore 40 to 60 feet thick and six miles long, which can be mined by open cutting. The Chesapeake & Ohio Railroad will run a branch line to the mines and works."

The Norton Fluid Metal Rolling Co. has been incorporated in Chicago, with a capital stock of $1,000,000, to manufacture metal sheets, plates, tubes, etc. The incorporators are Edwin Norton, Oliver W. Norton and C. C. Warren. The chartering of this company may mark an important era in the metal manufacturing industries of Chicago, if not of the whole country. Mr. Edwin Norton, one of the incorporators, is the inventor of the fluid metal rolling mill, and which is in successful operation at the can factory of Messrs. Norton Bros., Maywood, Ill. The machine there is employed in rolling solder 15-1,000 of an inch in thickness, and six or eight inches wide, which it rolls out at the rate of 500 to 600 feet per minute. A number of iron and steel manufacturers have looked into the invention with the idea of utilizing it in rolling iron and steel, and among those who have given it attention are some of the officers of what is now the Illinois Steel Co. It appears that the latter want the invention, and have made the Norton Fluid Metal Co. a large cash offer for the exclusive right to experiment with it for the term of two years in working steel into rails, plates, etc., and at the end of that time to buy the patents outright, should the experiments prove satisfactory. The latter are to be carried out entirely at the expense of the Illinois Steel Co. It is understood that the proposition is still under advisement, and that the entire transfer of the patents would involve several hundred thousand dollars.—[Industrial World.

Enlargements, Additions, etc.:—

The Columbia City (Ind.) Manufacturing Co. on Wednesday, the 15th inst., consolidated with the Akron Hardware Co., and will at once remove its entire plant to Akron, O.

Furnace A, of Carnegie Bros. & Co., Limited, at Braddock, Pa., was blown out on the 11th inst., for relining and other repairs. It will be ready for blast again about July 1, next.

The Hartford Machine Screw Co., Hartford, Conn., has completed plans for the erection of a new building 225 feet long by 45 wide, and two stories in height. The structure will be used mainly for a storehouse.

Messrs. J. A. Dunkle and S. F. Dunkle, of Steelton, and J. C. B. Ewing, of Harrisburg, have bought the entire plant and good will of the Star Steam Heater Co., of Mount Joy, Pa., including the exclusive control of the patents. Large and commodious shops will at once be built at East Harrisburg, Pa., according to new plans especially adapted for their business. Three departments, viz., boiler making, machine and foundry, will be fully fitted out with the best machinery.

The Columbia Steel Co., a Pittsburgh concern, whose extensive works are at Uniontown, Pa., are turning out some fine angle, tee and beam irons. The company are making additions to their works, in the shape of open-hearth furnaces; and it will not be long until the Columbia Steel Co.'s works will be among the largest of the structural iron makers in the country. They are now having made for them, by the Lewis Foundry & Machine Co., two large steam punching machines, intended for use on beams as large as 20 inches.—[American Manufacturer.

Fires and Accidents :—

The pattern shop of the Franklin Iron Works, Reading, Pa., was destroyed by fire May 11. Loss, $5,000.

The Harrison Wire Mills, St. Louis, which have been idle for more than five years, were completely destroyed by fire on the 5th inst. The loss is probably $40,000; no insurance.

Failures, Shut-downs and Wage Matters:—

The employes of the lapweld and buttweld departments of the National Tube Works Co., at McKeesport, Pa., struck May 16 for an advance in wages of 10 per cent. Two thousand men went out. The advance was granted.

The Oxford Iron Co.'s rolling mill and nail mill, at Oxford, N. J., have shut down, and a general suspension of the entire works is expected. The Delaware Rolling Mill, in Phillipsburg, has also shut down. One of the Lehigh Iron Co.'s furnaces, near Allentown, has been blown out.

General Industrial Notes :—

The Reading Iron Works, recently failed, have been appraised at $1,250,000.

The Arms-Bell Co., of Youngstown, O., have definitely decided not to rebuild their bolt works, recently burned.

Barnhill & Simmon's boiler works, at Bellaire, O., is working double turn, as the company is being pushed with orders.

The Niles Tool Works, Hamilton, O., are working twenty-three hours a day with all the men that can be conveniently employed.

The subject of spur gears is succinctly treated by the Brown & Sharpe Manufacturing Co., of Providence, R. I., in a neat folder, recently issued.

Traveling men will be pleased with a new form of memorandum book which the Avery Stamping Co., of Cleveland, O., will send out on application.

The J. A. Fay Co., of Cincinnati, O., booked on the 30th ult. two orders for $26,000—one for $15,000, the other for $11,000, besides the usual run of small orders. The former is from a firm in Chili, South America, the other from a Southern mill.

The Westinghouse Co., Pittsburgh, have sold to the State of New York three Westinghouse alternating current electric light dynamos for the execution of condemned criminals. The State prisons at Sing Sing, Auburn and Clinton are each to have one of these deadly machines, which will be driven by the engines already in place.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock, P. M., on the 7th day of June, 1889, for all the labor and materials required to fix in place complete a low-pressure return-circulation steam heating and ventilating apparatus, for the Court House, Postoffice, etc., building at Oshkosh, Wis.

Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until 2 o'clock P. M., on the 11th day of June, 1889, for the labor and materials required in the erection and completion of the iron roof, etc., for the U. S. Court House and Postoffice building at Pittsburgh, Pa.

The Cleveland City Forge & Iron Co., iron and steel forgings, turnbuckles, etc.; the Avery Stamping Co., seamless elevator buckets, special stamping; the Chapman Jack Co., patent jack-screws, and the Bronson Supply Co., never-break steel hollow ware, all of Cleveland, O., have joined in establishing a special agency for the South, for their different lines of goods, in the Neal Building, Baltimore, Md., with Mr. Alfred Ely as manager. This is flattering evidence of the growth of their Southern trade.

Another Promising Steel Process.

The Redemann-Tilford steel process, which has been attracting so much attention among the manufacturers of steel lately, seems to be in a fair way of being successfully used in a short time.

The company have secured a volume of certificates showing the results of tests of their process, which show it to be an absolutely new departure in the whole process of steel manufacture. The process is understood to consist of a bath with glycerine as the basis. This bath changes the whole structure of the metal submitted to it, and increases its ductile and tensile strength far beyond any record that has yet been established by either private or governmental test.

When it is stated that the very finest and strongest grade of steel, much better than any now in use, can be made by this process at little more than the cost of crude Bessemer steel, the value of the discovery may be understood. Thus far, in making experiments, every character of tool and steel goods has been worked with, and the process has been successfully used upon all.—[Manufacturers' Record.

Experiments with Bent Pipes.

Experiments recently made on the strength of bent pipes have developed some things not commonly known, or at least not recognized. We mean the strain on the inside of the angles, due to the effort of the pipes to straighten themselves under pressure. The problem is one of considerable intricacy, resolvable, however, by computation, and is a good one for practice by our engineering students. In the experiment referred to, a copper pipe of 6¾-inch bore, 3-16-inch thick, was used. The angle was 90 degrees, and the legs about 16 inches long from the center. At a pressure of 912 pounds to an inch, the deflection of the pipe was nearly ⅜ inch, showing an enormous strain on the inner side, in addition to the pressure.—[Exchange.

"ARDENBRITE," the new invisible lacquer just brought out in London, is proof against weather, steam, smoke, sea air, or sea water.

OUR IMPORTS OF IRON AND STEEL.

PHILADELPHIA BULLETIN.

We give below a table, compiled from the monthly summary of the Bureau of Statistics of the Treasury Department, showing the imports of iron and steel and iron ore into the United States in each of the first three months of the present year, and the total imports of these articles in the first quarter of 1889, as compared with the imports in the first quarter of 1888.

ARTICLES—GROSS TONS.	Jan.	Feb.	Mar.	1st qr., 1889.	1st qr., 1888.
Pig iron	17,344	14,946	17,120	49,410	48,748
Old and scrap iron	1,831	3,718	5,107	10,656	17,455
Scrap steel	197	84	18	299	2,277
Bar iron	4,089	1,517	1,286	6,892	5,797
Iron rails	none	none	none	none	none
Steel rails	1,500	2	4,578	6,080	31,749
Cotton-ties	none	235	246	481	111
Hoop and scroll iron	3	none	3	6	238 lbs.
Steel plates, etc	2,783	1,111	1,487	5,381	6,954
Steel blooms, etc	12,971	8,996	9,451	31,418	25,269
Sheet and plate iron	597	402	597	1,596	1,613
Tin-plates	23,794	26,650	31,498	81,942	63,915
Wire rods	9,026	6,715	8,739	24,480	32,503
Wire and wire rope	281	302	279	862	714
Anvils, forgings, etc	78	129	221	428	381
Chains	76	70	49	195	223
Total	74,570	64,877	80,679	220,126	237,709
Iron ore	76,578	68,619	55,348	200,545	175,284

It will be noticed that the imports of iron and steel in the first quarter of 1889 do not equal the quantity imported in the first quarter of 1888 by over 17,000 tons, but that the imports of iron ore in 1889 exceed the quantity imported in the first quarter of 1888 by over 25,000 tons. The quantity of tin-plates imported in the first quarter of 1889 is enormous, exceeding the quantity imported in the first quarter of 1888 by over 18,000 gross tons, and forming more than one-third of our total importations of iron and steel in the first quarter of 1889.

The total foreign value of our imports of iron and steel in the first three months of 1889, excluding iron ore, and including machinery, cutlery, fire-arms, and similar products the weight of which is not given in the above table, was $10,711,332, against $10,547,344 in the first three month of 1888. The foreign value of the tinplates imported in the first quarter of 1889 was alone $5,265,707.

REDUCING IRON FREIGHTS.

The railroads of Pennsylvania have at last commenced to reduce their freight rates to iron and steel manufacturers. In the Lehigh and Schuylkill valleys the rates on anthracite coal were slightly reduced late in April, and at the same time the price of anthracite coal itself was reduced to the furnaces 25 cents per ton, or from $2.10 to $1.85. At the same time the Pennsylvania Railroad Co. reduced the rate on Connellsville coke to Philadelphia 11 cents per ton, or from $2.50 to $2.39, and the Pennsylvania Co. reduced the rate on pig iron from the Mahoning and Shenango valleys to Pittsburgh 15 cents per ton, or from 80 to 65 cents. Last week the rate on Lake Superior iron ore from Buffalo to the Lehigh and Schuylkill valleys was reduced 20 cents per ton, or from $1.75 to $1.55. Last Monday the Pennsylvania Railroad Co. reduced the rate on bituminous coal from the Clearfield region to Philadelphia to $2 per ton, and for shipment to $1.70. The Baltimore & Ohio and the West Virginia Central roads also reduced their rates on bituminous coal to the same figures. It is confidently expected that rates on iron ore from Lake Erie ports to Pittsburgh and Johnstown will be reduced this month, and that the rates on Connellsville coke to Pittsburgh furnaces will also be reduced. It is also worthy of mention that the Pennsylvania Railroad Co. has recently reduced its passenger rates from Pittsburgh to Philadelphia and New York about 10 per cent.

Following this movement comes a reduction in freights affecting the Mahoning and Shenango valleys, as appears from the following dispatch from Pittsburgh, May 16: The Pittsburgh & Lake Erie, Pennsylvania, and Pittsburgh & Western railroads have reduced the freight rates on pig iron, blooms, scrap, muck, bar, etc., to and from the Mahoning and Shenango Valley blast furnaces 15 cents per ton. The former rate was 80 cents. It is now 65 cents. This reduction is in effect between Cleveland and the valleys as well as between Pittsburgh and those points. The depressed condition of the iron trade caused the railroad companies to make the reduction. The rates on the Baltimore & Ohio and Pittsburgh, McKeesport & Youghiogheny, between the Connellsville district blast furnaces and Pittsburgh, have been correspondingly reduced. A similar cut has been made on the first named road between this city and Cleveland.

PITTSBURGH MEN ON IRON SHAFTS.

PITTSBURGH DISPATCH.

A revulsion of feeling regarding the supposed superiority of steel over iron for heavy shafts for steamboats has been gaining strength for some time, and it is said that nearly all steel shafts that break now-a-days are being replaced by iron. It is also stated that those made by Krupp, the German iron worker, have fared no better in builders' estimation than some made in this country.

Considerable inquiry was made on the subject yesterday, and the only one who gave a good word for the steel shaft was Mr. David Shaw, Superintendent of the steel works at Chartiers. He stated that he thought good steel would answer the purpose, but that some kinds would be no better than pig iron.

Mr. James A. Henderson stated that the shafts on the Scotia, Katie Stockdale, John Moran and Beaver had all been replaced lately with iron. Mr. Henderson explained that steel seemed to be affected something like French plate glass. When a fracture is made in the latter, it continues to extend, unless a hole be bored at the end thereof, and the manner in which the particles of steel were pressed together appeared to deprive them of tenacity or coherence.

Mr. Henderson instanced the familiar experience of finding broken iron axles on various kinds of vehicles, where it is often seen that the axle has been doing duty for a long time partially broken, the old fracture being plainly visible. With steel it is different. When a shaft begins to give way the fracture extends rapidly.

Iron shafts have been known to do duty for a quarter of a century, doing good service long after the fissure began to yield.

A gentleman at the office of Carnegie, Phipps & Co., stated that they had made quite a number of iron shafts for steamboats lately. He attributed their superior strength to the fine quality of iron used in making them, and to their superior torsional strength.

From the above it may be inferred that the qualities that go to make steel superior to iron for rails are not called into play, or are not adapted to the strain a shaft is required to sustain.

Record of the Hinkle Charcoal Blast Furnace.

Considerable attention has been attracted by the heavy output of the Hinkle furnace plant at Ashland, Wis. While 85 tons of pig iron in 24 hours has been the best heretofore done by a charcoal furnace, this plant has made as high as 112 tons in that time. The furnace stack is 60 feet high and 12 feet in diameter at bosh. Four casts are made daily and each cast covers considerably more than half the floor of the cast house, hence the latter will soon be enlarged to accommodate the increasing product. The following record from the *American Manufacturer* of the work of the month of March, shows that at least one charcoal furnace in point of improvement is keeping pace with the coke furnaces:

Statement of Pig Iron Manufactured at Hinkle Furnace during March, 1889.

March.	Tons.	March.	Tons.	March.	Tons.
1	99	12	98	23	110
2	89	13	96	24	96
3	100	14	87	25	86
4	95	15	86	26	96
5	98	16	84	27	101
6	104	17	89	28	102
7	107	18	96	29	102
8	110	19	100	30	102
9	105	20	104	31	112
10	95	21	105		
11	64	22	96	Total	3,004

On the 11th the furnace was stopped eight hours, on the 16th three hours, and two hours on the 15th and 19th.

Natural Gas in Australia.

Nearly five years ago Mr. John Coghlan commenced to bore for coal in the neighborhood of Narrabeen. He put down his diamond drill about half way between Manly and Newport, and at the foot of a range of hills. After boring for two or three years, probing 1,556 feet down and finding no trace of coal, the miners observed an inflamable vapor exhaling from the side of the bore. With nearly 2,000 feet of tubing down, the vapor increased in volume and intensity. Then Mr. Coghlan began seriously to consider its nature, and, having no knowledge of the valuable gases engendered in Nature's own laboratory in other parts of the world, he invited Dr. Storer, a scientific chemist, and Mr. Key, a mining engineer, to inspect the bore. These gentlemen visited the scene of operations several months ago, offering the opinion that the gas was similar to that discovered at Pittsburgh, and subsequently analyzing some which they carried away in a bottle, stated definitely that the product was in all respects identical with the American natural gas. The bore they put down measured three inches in diameter, and the gas issued through it in spite of a pressure of water equal to 800 pounds to the square inch. If the well proves rich in gas, pipes will be laid from Narrabeen to the city, and the natural product delivered, when mixed with coal gas, to the dwellings for light, and unadulterated to the factories and workshops for fuel. Meanwhile the few workmen employed at the wells are boiling their billies and grilling their steaks on the gas that flows up over the surface from hundreds of feet beneath them, and at night they are illuminated by the same product.

Model for a Newspaper Train.

The Toronto Pattern Model Works, Toronto, have recently constructed a model of the *Globe* fast train that carries that paper as far west as London, Ont., early every morning several hours in advance of all other city papers. The model is eight feet long and weighs over 100 pounds. It consists of locomotive 702 and car 601, standing on steel T rails spiked to oak sleepers. The engine is made of steel, iron and brass, and is so well proportioned that though the smokestack is four inches in diameter, this would hardly be supposed at a casual inspection. The locomotive is fitted with sand dome, whistle, bell, headlight bearing the train number, air brake and every detail of a real iron horse, except, of course, the internal arrangements. The tender is loaded with coal and the tanks underneath filled with water. The cab is upholstered in blue plush, ready for the driver to step in and open the throttle-valve. The car body is of wood, and all through the same materials have been used as are employed in the construction of an ordinary car. At some of the windows the blinds are dwarf; the weather bulletin, which many a farmer looks for daily, is displayed on the side, and all the little details have been so carefully attended to that a very pleasing general effect is achieved. The scale is about one to nine.—[Canadian Manufacturer.

ENGLISH letter in *American Manufacturer:* It is stated that there is already a scarcity of puddlers, and that this scarcity will become more marked later on. In the Sheffield and Rotherham districts under-hands cannot be obtained—the men alleging that the work is too hard and the hours to long for the wages given. Many men appear to have left the trade altogether, and will not return.

TECHNICAL MATTERS.

Reduced Cost of Rails.

As an illustration of the activity with which the production of rails is being developed in Austria it is stated that, whereas formerly 50 tons of rails used to be produced at the Graz Works in twelve hours, and for every ton produced 22 per cent. had to be reckoned as waste, with a consumption of fuel amounting to 1,010 kilos., they are now turning out from 100 to 110 tons of rails in twelve hours, the waste only amounts to 12 per cent., and the coal used to produce one ton of rails does not exceed 730 kilos.

New Device for Wire-Making.

Wire is now being manufactured—whether iron, copper or brass—by a new and greatly improved process, and at a considerably reduced cost. The machine devised for this purpose consists of a series of rolls in a continuous train, geared with a common driver, each pair of rolls having a greater speed than the pair preceding it, with an intervening friction clutch adapted to graduate the speed of the rolls to the speed of the wire in process of rolling. The entire operation of producing the smallest sized wires from rods of one-half inch is done cold. It is alleged that this method obviates the danger of unequal annealing and of burning in the furnaces—in addition to this the wire being more flexible and homogeneous than that made by any ordinary method, and capable of sustaining greater longitudinal strain; in the case of copper wire there is said to be a greatly increased electrical conductivity.

New Smoke-Consuming Device.

A new smoke-consuming device has been invented that is attracting the attention of cities and railroad companies. It is claimed that better results are obtained from two or three tons of coal by the use of this smoke-burner than were formerly obtained from four to five tons. The Chicago *Tribune*, describing a test recently made of it in that city, says: "The trial was a satisfactory one. The principal of the device is sound. It is the introduction over the fire-box of a jet of superheated steam, which should have a temperature of over 600 degrees. The oxygen in this system seeks its natural affinity in the carbon of the coal, and causes it to burn at an intense white heat, so that it passes away as carbonic acid and not as carbonic oxide. The hydrogen liberated from the oxygen of the water combines with whatever loose oxygen of the air it can find, and also burns at a white heat. There ceases to be any smoke, for the carbon is all consumed."

Square Driving Ropes.

According to *Industry*, some experiments recently made in India with leather ropes of a square section are deserving of attention. Square leather ropes have for some time been used in England, and with success. They are especially suited for what are called "quarter twist" belts, not being affected by the diagonal strain as a flat leather band is. The sections are square, equilateral, and the grooves in which they run are made to an angle of 45°, so there is a perfect fit of one-half the surface of the rope, and more than possible with a flat band of equal weight; not only this, the traction is more because of the angles. The square leather ropes employed for main-driving are about 1¾ inches square, made up of layers of leather cemented so the whole is uniform and continuous. A rope of this size weighs 1 pound for each foot of length and will sustain a pull of 600 pounds. A single rope of this size will, at a speed of 25,000 feet a minute, transmit 25 horse-power. They are, however, driven at much higher speed than this, in some cases to 6,000 feet per minute; a safe or suitable speed is from 4,000 to 5,000 feet a minute.

New Tests for Cast Iron.

The advisability of ascertaining the precise nature of the various qualities of cast iron has caused the "Keep" tests for that metal to be largely adopted. The old practice in specifying the quality of cast iron was content with describing the mixture of the pig, the physical character of the product, and breaking strength. The tests now in question, however, according to the *Mechanical World*, furnish more precise indications of the quality of cast iron. In carrying them out a sample of the metal weighing 15 pounds is melted in a plumbago crucible set in a brass furnace, and from this three sets of test bars are run. One bar is ½ inch square, and is cast with both ends against chills 13½ inches apart. Another bar, also run between end chills, is ½ inch wide and 0.1 inch thick. When the bars are cooled, so that they and the chills are of the same temperature, the shrinkage is measured by inserting a taper gauge between the end of each bar and the chill. A third bar is run to test the fluidity; the mould being 12 inches long, 1 inch wide, and 0.06 inch thick. This is run from one end, and is poured first; but the strip rarely runs full to the end, and its length is taken as the index of the fluidity of the metal. The fourth bar is called the "crooked strip," and is 12 inches long, 1 inch wide, and 0.086 inch thick. On the centre of one side is a rib 0.412 in. high, 0.2 in. wide at the base, and 0.1 in. wide at the top. The unequal shrinkage of the thin flat strip of the taper rib causes a slight curve in the bar, and the measurement of this is called the "crook." The square bar is tested for transverse strength by means of gradually applied weight, the deflection being measured at the same time. The second rectangular bar is tested for resistance to impact; the test being the fall of a 25-pound hammer, at first with a fall of ½ in., increasing by eighths of an inch until the bar breaks.

Steam vs. Water Power.

At the recent Erie meeting of the American Society of Mechanical Engineers, the "Comparative Cost of Steam and Water Power," was considered in a paper by Charles H. Manning, the data being drawn from the towns of Lawrence, Lowell and Manchester, on the Merrimac River, which were created by their water-powers. The Lawrence water-power is owned by the Essex Co., who have sold 130 mill-powers. The unit of water-power varies slightly in the different places, that in Lawrence being 30 cubic feet of water per second on a fall of 25 feet, while at Manchester it is 38 cubic feet per second on a fall of 20 feet; the first being equivalent to 85.23 horse-power gross, and the latter to 86.36 horse-power gross. Cost per horse-power per annum at Lawrence:

Under original leases	$10.55
Surplus water up to 20 per cent.	14.51
Surplus water from 20 per cent. to 50 per cent.	29.02
Under recent leases	14.08

At Lowell the cost is:

Under original leases	$10.55
Surplus water up to 40 per cent.	18.14
Surplus water from 40 per cent. to 50 per cent.	36.28
Surplus water from 50 per cent. to 60 per cent.	72.56

At Manchester the cost is:

Under original leases	$10.42
Surplus water	7.15

In computing water-powers it is usual to subtract one foot from the head as measured from still water. The efficiency of the turbine being taken at 85 per cent. of the net fall, about 75 per cent. of the gross power paid for will be delivered to the shaft. Under the original leases the net horse-power costs $14. The total cost per net horse-power per annum under the original grants is:

Cost of water	$14.00
Sinking fund, etc.	7.90
Attendance and supplies	.72
Total	$22.62

We now come to the steam side of the question. The cost per net horse-power per annum of a compound engine of 1,000 horse-power is $21.16, and the cost per horse-power for a single-cylinder engine, the exhaust steam from which is used at a pressure of about 10 pounds above the atmosphere for other than power purposes, is $14.58.

A REMARKABLE OCEAN VOYAGE.

SCIENTIFIC AMERICAN.

Five days, twenty-three hours seven minutes is now the top record across the Atlantic, the City of Paris making it on her last trip this way—a remarkable trip, not only because it beats by two hours forty-eight minutes the best previous record, to wit, that made by the Etruria last June, but because she is a new ship, and, at least, for a small portion of the voyage—crossing the Banks—was slowed down. Thus it is not unreasonable to expect still more of this ship, when her engines shall have become more smooth by attrition, and her commander more familiar with her characteristics.

To many the mere fact of record beating will not compare in importance with the fact of using double engines and twin screws on so big a ship. With these and the arrangement of bulkheads which they permit, the safety of a ship is believed to be increased. Heretofore, a steamer parting her shaft lay helpless on the broad ocean, her sole reliance the coming of another ship to her rescue.

There is another and perhaps it might be called a still more important factor of safety in the twin engine arrangement—it permits the subdivision of that longitudinal section of compartment which heretofore has made the most modern ship vulnerable abaft the main mast. This contained the engines and the boilers, and the gross weight of sea water it would contain was sufficient to more than counterbalance the ship's buoyancy. With the sister ships City of New York and City of Paris, this compartment is divided into two parts, a separate engine and boilers being placed in each. Should one of these be torn open by collision and flooded, it would not swamp the ship or even destroy her power of locomotion. She would heel over a few degrees in the direction of her hurt, a condition that, to a certain extent, could be rectified by a slight shifting of the upper cargo, if the sea was fairly smooth. In any event, the second engine would go on driving its propeller as though nothing had happened, save for the diminution of speed.

It ought to be added that though the safety of passengers is still further assured by the new type of steamer, vessels that may be in or crossing the steam lanes have additional dangers to fear, not for the greater speed now obtaining, for they have not anything to fear from that during clear weather, but for the desire for quick passages which it induces, and the resultant haphazard running in thick weather to insure them.

How Patents Multiply.

The Patent Office *Gazette* for March 19, 1889, contained Patent No. 400,000, and a handsome start has since been made on the fifth hundred thousand. The issues are piling up at the rate of nearly 2,000 a month. The rate of accumulation is a constantly accelerating one. Thus the issuing of the first hundred thousand patents covered the whole period of eighty years, from 1790 to 1870; while the fourth hundred thousand were issued between June, 1884, and March, 1889, a period of less than five years. Even at the present rate of increase, the close of the century will see between 600,000 and 700,000 patents on record in the United States, and, judging from the past, the number is likely to be very considerably in excess of these figures.

The degree of mental and physical activity which these statistics imply, and the constant change and improvement in everything pertaining to human life which this tireless energy of invention brings about, are subjects for reflective consideration. Taken in connection with the rapid growth of the country in population, the organizing of new states with scores of new towns which, in their first decade become cities, and in their second take rank as great industrial and commercial centres, the question becomes an interesting one, what will the little child of to-day be privileged to see, should he be spared to a ripe old age? Many such among us will live to read the history of the first half of the twentieth century. To them it will be as a tale that is told; to us it is a sealed book, full of unknown wonders faintly indicated by the achievements of our own time.—[Mechanical News.

FOREIGN COMMENT.

French Iron Statistics.

The statistics of the coal, iron and steel production of France in 1888 have just been published. They exhibit a marked increase in the output of coal, and a smaller increase in the manufacture of iron and steel. In 1887 the colleries of France yielded about 21,000,000 tons of coal; in 1888 they gave 22,500,000 tons. The precise amount of the increase is 1,664,351 tons, of which the largest share was furnished by the departments of the Pas de Calais, Nord and Haute Loire. The total yield of the French blast furnaces in 1888 was 1,688,976 tons. The quantity of puddled and refined iron was 833,839 tons in 1888, as against 771,610 tons in 1887. Puddled and other steel, as rails, plate, etc., was produced to the amount of 575,646 tons in 1888, as against 493,294 tons in 1887.

Iron Trade in Italy.

During the last few years the manufacture of iron and steel has made great progress in Italy, although until a comparatively recent period the ironmasters had to contend against serious disadvantages and realized very scanty profits. Owing to the activity prevailing in the building trades, a great demand for small girders, of 14 to 18 centimetres, has sprung up in Rome and other large towns, and this description of iron has been hitherto supplied by Belgian firms, who, however, will probably lose the trade at no distant date, since girder iron of good quality is now being manufactured at Florence, Savona and Terni, and new rolling mills are to be erected at Terre del Grico and Decimo. The engineering works in Italy are also prosperous, and many of the establishments are now as well fitted for the production of boilers and machinery as any firm in Central Europe. The Italian iron trade has received a great impulse from the new protective tariff.

The Swedish Iron Industry.

It is said that 959 iron mines are at present open in Sweden, although 233 are only worked sufficiently to avoid the forfeiture of the concession. Most of the mines are situated in the province of Gefle, Kopparberg, Vermland, Dannemora and Gellivara, the total output of ore being estimated at 867,500,000 kilos. At the present time there are 164 furnaces in blast with an annual production of 442,000,000 kilos., the only fuel used being charcoal, 5 to 8 cubic metres of which are used to produce 1,000 kilos of pig iron. The number of rolling mills in Sweden is put down at 217, which turn out about 24,000,000 kilos. of bars, the iron being generally refined by the same process as the Lancashire works. In the Dannemora districts, however, the ironmasters adhere to the system introduced from Holland by Louis de Geer, in the 17th century, and which requires 17 to 23 cubic metres of charcoal for the production of one ton of iron. Altogether about 6,400 hands are employed in the Swedish iron mines and rolling mills.

Effect of High Temperature and Pressure on Carbon.

In some experiments on the effect of high temperature and pressure on carbon, by C. A. Parsons (*Jour. Chem. Soc.*), carbon rods were surrounded by benzine, paraffine, treacle, chloride or bisulphide of carbon, and submitted to great pressure in a hydraulic press, the rods being meantime heated by passing an electric current through them. In some cases a considerable amount of gas was evolved, and a soft, friable deposit of carbon produced. In no case was the density of the carbon increased. When the rod was surrounded with silica the latter fused, and the rod was largely converted into graphite; the same occurred with hydrated alumina in lime or magnesia, the rod being rapidly destroyed with evolution of gas. With layers of coke, lime and silica, the rod was rapidly corroded, and was found after the experiment to be coated with a coke-like layer of great hardness, sufficient to scratch rock-crystal and ruby, and to wear down the cut facets of a diamond. It resists the action of a mixture of hydrofluoric and nitric acids. The conditions of temperature and pressure with presence of moisture, lime and silica, resemble those which appear to have existed in the craters of the Cape diamond mines. The part played by the lime and silica is not clear.

Recovering Old Metals.

On Thursday we had the pleasure of witnessing a new process for the recovery of metal, which has been patented by Mr. J. E. T. Woods. The merit of the invention appears to lie in the facility with which metals can be extracted and recovered that are contained in such refuse stuff as castaway tins, boxes, cases, etc. The process was shown in the presence of a considerable assemblage at the Trafalgar Works, Old Kentroad. The old metal was first heated in an oven, and the solder removed, and then, after being broken up, it was placed in crates and sunk in a solution of costic alkaline, which had been heated up to about 500 degrees. When it had passed through this course it was shown that the tin had been entirely stripped from the iron, and the matter was ready for forging. Of course, only high-class iron could have been used for the purposes these boxes and cases had answered, and it was maintained that the invention restored it to its original condition, and without that brittleness which is generally inseparable from the ordinary acid process, by reason of an admixture of tin, the acid destroying the iron, while the alkaline preserves it. Some of the metal which had been experimented upon was subsequently plated in the forge, and welded into cork-screw shape for the purpose of proving the value of the process.—[Iron & Steel Trades Journal.

Foreign Notes.

The French army is making a trial of a small electric lamp which is to be employed in searching the field of battle for the wounded.

Recently the second of two monster guns was placed on Calais heights. The weight of these pieces of ordnance is said to be from 45 to 46 tons, length of bore 36 feet, weight of projectile 1,008 lbs., and the charge 476 lbs. They are breech-loaders, with a range of 10 miles

Recent trials show that very thin blades, as flat springs and cutlery blades, can be effectually hardened and tempered by heating them and thrusting them into a mass of mineral wax, crude paraffine. The needles of sewing machines and small drills have also been so treated successfully.

CANADIAN INDUSTRIAL NOTES.

CANADIAN MANUFACTURER.

Work on the Canadian ship canal at Sault Ste. Marie, Ont., is being pushed in much vigor. About 100 hands are now at work, which number is to be largely increased.

Mr. Charles S. Burt, of Marquette, Mich., was in Toronto last week making inquiries with a view to the erection of iron smelting works somewhere in Canada. Mr. Burt's father and other members of his family have been engaged in the manufacture of charcoal iron in Northern Michigan for the last thirty years, and, with the experience he has of the business and the capital he is able to command, he should be able to make a successful venture in Ontario.

The Polson Iron Works Co., of Toronto, who recently established a shipyard at Owen Sound, Ont., for the construction of iron vessels, and who, about a year ago, contracted with the Canadian Pacific Railway Co. for the construction of a large steel steamer to ply between Owen Sound and Port Arthur, successfully launched that vessel on May 4, just eleven months after the signing of the contract. The Manitoba, as the new steamer is called, is the largest vessel afloat on Canadian inland waters. She is 305 feet long, 38 feet beam, will have a draught of 13 feet, and a capacity of 3,500 tons; the engines being of 2,000-horse power. The cost of the vessel will be, when completed, about $250,000. The Polson Iron Works Co. have contracts on hand for the construction of a large steamer for the Parry Sound Lumber Co., and a ferry steamer for the Canadian Pacific Railway Co., for making the crossing of the Detroit River, at Detroit, which will be considerably larger than the one they have just launched. The Toronto works give employment to about 300 hands, and the Owen Sound works to 500.

Mr. Wm. Hall, manager of the Spring Hill, N. S., mines, gives the following account of the successful completion of a winding plant, situated on the surface, and hoisting from an underground slope. A bore-hole four inches in diameter has been put down from the surface to the bottom of 1,300-foot level (North slope), a depth of 600 feet perpendicular. An engine and boiler have been placed in position on the surface close to the bore-hole. Power is then transmitted by means of a wire rope, and an arrangement of pulleys at the top and bottom of the bore-hole. Beside the wire rope in the bore-hole is placed a signal cord. By means of this cord communication is kept up between the engine-man and the man at the bottom. The first cost of the bore-hole is not nearly so great as that of 1,800 feet of steam pipes, while the cost of repairs, where pipes are suspended from the roof by means of hooks, will be entirely saved. Other repairs necessary to prevent leakages in the pipe will also be obviated, thus effecting a very material annual saving.

A numerously signed petition was recently presented to the Dominion authorities, asking for changes in the Canadian patent regulations. The petitioners ask for the introduction of legislation on the subject as soon as possible. It is urged that the full term of a patent of invention be made twenty years, to be divided into four optional terms of five years each, with progressive fees of $10, $20, $30 and $40 for each term, respectively. This would act at once, save the Canadian patentees the loss of two years' duration of their United States patents, and it would do away with the delays and other disadvantages that the Canadian inventors are generally subjected to in order to get priority of issue in the United States. Such priority is sought as the only means at present by which Canadian inventors can save themselves from this serious loss of time; for, although the United States patents are otherwise issued for seventeen years, yet they terminate with the Canadian patent; when issued, the full term of the latter is only fifteen years. The change suggested would, it is said, operate at once in saving the Canadian inventor from loss of time, and the immediate applications for patents in Canada would be facilitated.

Iron Developments in Washington.

The development of the iron resources about Port Townsend, Washington Ter., seems to be progressing very satisfactorily at present through the operations of the Puget Sound Iron Co. This company was incorporated in November, 1881, with a capital of $500,000, and built an old-fashioned stone open-topped furnace about that time to demonstrate that iron could be made from its Puget Sound ores. Subsequently the present stack was built, and last November over 900 tons of pig iron was produced, and over 1,000 tons the month following. The furnace is situated at what is now called Irondale, a new town laid out a short distance south of Port Townsend, where a water frontage of over 1,000 feet on the bay is owned. Adjoining the town and furnace property of the company is a well wooded tract of land containing iron ore beds. The company also own, on Texada Island, in the Strait of Georgia, on the direct waterway to Alaska, and about 130 miles from Irondale, a tract of more than 2,400 acres, having a good frontage on Gillies' Bay, on which are extensive beds of magnetic ore. Plenty of limestone for fluxing can be had in the immediate proximity to the ore beds, it is said.—[Age of Steel.

Remarkable Bridge Building.

The surprising announcement is made that the Sukkur Bridge over the Indus River has been completed and opened nearly six months in advance of the anticipated time, and for a sum 400,000 rupees, or $130,000, below the estimated cost. If there was nothing else remarkable about this bridge these two circumstances alone should suffice to give it and its builders a lasting celebrity. —[Mechanical News.

THE BRYANT CHANNELLER.

There have been many improvements in the last few years in the machinery used in quarrying stone. A quarry at the present time must have its steam plant, with its steam derricks, steam drills and steam stone cutters, or it is behind the times.

We illustrate on this page a new steam stone cutter or channelling machine.

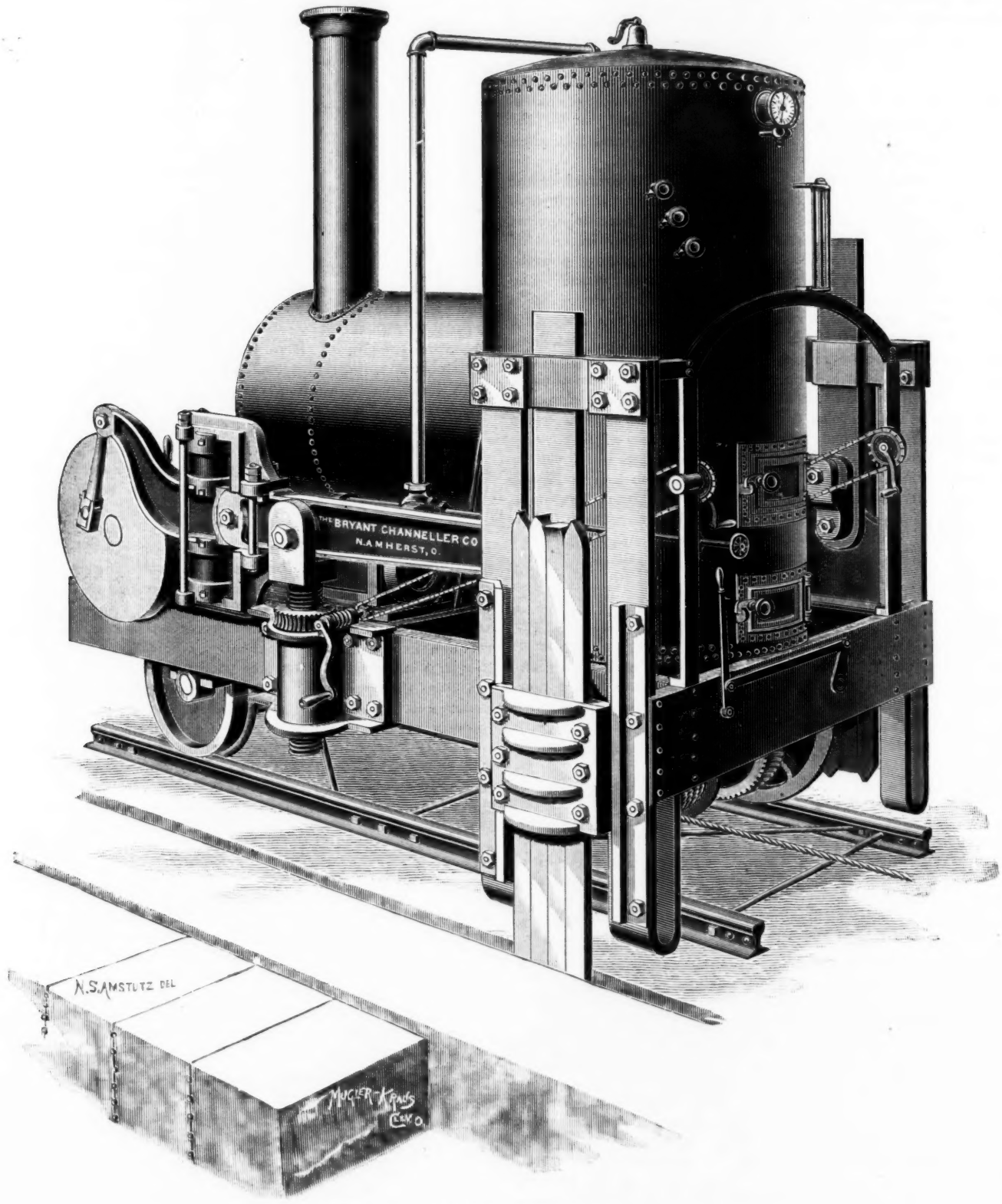
It seems to be absolutely necessary in a machine for this purpose that the tool-carrying part be yielding, both in striking the blow on the rock, and in lifting the tools and recovering from the down stroke. This is attained in this machine by means of a jointed lever working on the 8x5½ rubber springs, placed in a yoke and on each side of the lever. The stroke is given and the drills lifted on the springs. There is no shock transmitted on the other parts, the rubber receives it all. This affords sufficient cushion, great strength, and with the peculiar construction of this machine, great durability.

The machine is operated from either end, works up to corners, and cuts close to the wall on the sides, steams easily, will burn slack coal and work both sides at one time. Its propelling arrangement is a very simple friction clutch, which is not so positive as to force the machine up against the end of the cut or impediment, and not yield if not stopped or reversed. Among the other advantages are the following:

First. It will work on an incline of one foot in ten with perfect safety. This is accomplished by using worm gear to propel the wheels, and this is attached to both fore and hind wheels, giving traction to all. Besides this, where the incline is too steep, use a drum on one of the axle-trees, same size as the tread of the wheel, and attach a wire rope to it, and make fast to a plug at the upper end of the cut. This is wound onto the spool going up, and unwound coming down, making a positive feed. The great advantage of this device, when a machine is working from under a derrick, will be appreciated by quarrymen, as can be seen. The machine moves easily up hill to get to higher or down to lower benches in the quarry. Besides the advantage in moving, it is of greater advantage when the beds of the rock are sloping. It cuts it with the beds without blocking up the track to a level.

Second. The fall or lowering of the drills is accomplished by a screw on the fulcrum, which lowers the cutters to the extent of 15 inches, without stopping the machine, thus saving a great amount of time. On sandstone, this fall would be double the amount that a machine would cut without change of cutters, and in hard stone three times the amount. In marble or limestone, it will save five stops to lower the fall. Besides all this, it is only necessary to feed just what the cutters are cutting, an inch for instance. This takes the pressure off from the rubber springs. They can be much stiffer on this account, and never get compression enough to burst them. One set will last a whole season in sandstone, and much longer in lime or marble.

Third. A reamer is used in connection with the other drills, making four tools in a gang. The end of this is blunt and tempered very hard. It is upset the width of the cut and set up about an inch or 1½ inches above the cutters. It trims down the sides of the cut to full width, and rims it out a little at a time as the cut is sunk down. This takes a great deal of wear off from the cutters, and allows them to work free and without the usual sticking. It is possible to sink 20 feet with this, where the chips can be taken away. In sandstone, in cutting the old way, the cutters, go down, say six inches. The cutters are narrowed up about one-half inch for the next cutting, and the cut is one-half inch narrower at the bottom than the top. A sharp set of cutters are now put in, the same gauge as those taken out, and the whole six inches are rimmed out at one time. Of course the drills stick and hang. The machine is run against them, forward and back, to loosen them. This is what uses up rubbers, levers and everything else about a machine, together with the operator's patienec.



THE BRYANT CHANNELLER.

It takes one man to run it and look after steam and water. It will take two smart men to keep the chips out on one side. The parts are mostly steel and put together in the most substantial manner and it will do the work of 25 men, and do it better than is possible to do by hand.

These channellers are manufactured by the inventor, Wm. H. Bryant, North Amherst, O., who will gladly give any further information desired.

INCREASE OF MANUFACTURING INDUSTRIES.

NEW YORK TRIBUNE.

The reports of the Bureau of Statistics of the Treasury Department as to other materials of industry do not indicate an increase in all branches, or even the maintenance of manufacturing activity at the level of last year. Thus of India rubber the imports were but 9,479,871 pounds for the three months, against 11,058,541 last year, and of flax, hemp, jute and sisal only 52,996 tons, against 68,647 last year. In silk there was a little increase, 1,638,826 pounds of raw silk having come in during the quarter, against 1,418,603 last year, but the gain was wholly in January, for in February and March there was a decrease. The imports of pig and scrap iron were but 60,365 tons, against 68,480 in the same quarter last year, and of tin in bars or blocks but $1,525,559, against $2,768,812 for the quarter last year. On the other hand, in steel ingots and blooms there was an increase, 61,376,520 pounds, against 56,603,109 last year, and a moderate increase in paper stock, hides and free chemicals.

In the light of these official reports some estimate may be formed of the progress of the great manufactures since the last census. Thus the imports of raw silk are larger than last year, but last year were 5,473,732 pounds, against 2,562,246 in 1880, an increase of 114 per cent. in eight years. The imports of India rubber fall off a little this year, but last year were 34,484,033 pounds, against 16,826,099 in 1880, an increase of 105 per cent. in eight years. The imports of hemp and its substitutes were 201,301 tons, against 113,380 in 1880, a gain of 77 per cent. The consumption of raw cotton in manufacture, according to the *Financial Chronicle*, was 2,530,000 bales of 400 pounds each last year, against 1,981,000 in 1879-80, a gain of 28 per cent. Mr. Lynch's report also makes the consumption of raw wool 29½ per cent. larger than in 1880, though official reports differ. The Iron and Steel Association makes the consumption of pig iron, notwithstanding the decrease from 1887, no less than 6,688,744 gross tons in 1888, against 3,990,415 in 1880, an increase of 68 per cent.

Using these figures in connection with the census of hands employed in the different industries in 1880, and assuming that the number has increased in proportion to materials consumed—if not, improved machinery has made labor more effective—the comparison of industries in which more than half a million persons were employed nine years ago may be stated thus:

Hands employed in	1880.	1889.
Iron and steel	140,978	237,000
Silk	31,337	67,000
India rubber	6,269	13,000
Cotton	172,544	221,000
Wool and worsted	161,557	209,000
Total	512,685	747,000

The number of hands engaged in working up flax, hemp and its substitutes cannot be exactly stated, but the increase was probably from about 5,000 to about 9,000. Thus in these industries there appears an average gain of more than 50 per cent. in eight years, far exceeding the increase in population, a gain which implies a relatively increased home demand for the products of American agriculture.

THE EVOLUTION IN BUILDERS' HARDWARE.

AGE OF STEEL.

The hardware business is eminently a thing of change—not of whims and fancies—but of improvement. In no other business is practical utility so required in every article. Goods of great popularity are inevitably goods of great merit, and the reason is not far to see. Hardware is, of all things, intended for use and not for show. Appearances are of value only when in keeping with the general character of the article, and not when they conflict with the end for which it is designed. So for years the standard of excellence has been steadily tending upward, and in nothing has this been more marked than in builders' hardware. About a score of years ago the manufacture of bronze hardware may be said to have been in its infancy. There were but few concerns engaged in it, and the designs were of the most primitive style. The present craze for decoration had not then begun, and anything in the shape of ornamentation on bronze goods was considered good enough. Stability had the call on adaptability and appropriateness, and staid respectability was preferred to artistic designs. The goods were handsome in the same sense that old-fashioned four-post mahogany bedsteads were handsome, but they were solemn-looking and unattractive. There were but few designs to select from, and if in them you found nothing to suit, you had to take what you could get or go without it. Harmony with the surroundings was not accounted of any great moment, and you paid a great price for a conventional design that everybody else had, and were content. With increasing wealth came a demand for something better, and the new era of bronze hardware came in along with that rage for artistic decoration that has been so admirable in many ways, and yet withal so badly overdone. Now styles, finishes and designs are so numerous that no man pretends to keep track of them, or even to recognize them when seen. Small fortunes are spent in getting out new designs that often either fall flat from the date of their inception, or have a brief existence and soon become stale and unprofitable. On the other hand, a manufacturer often brings out a design that is really beautiful and original, and it has a great run, and is imitated by every other manufacturer, but, as a rule the imitations don't go for much. There are styles for every fancy and every kind of liking, and no designer may know what reception his pet pattern will meet with. Even now the pendulum of taste is swinging back from the excessively ornate to the excessively plain.

It may well be imagined that this sort of thing is very expensive to manufacturers. Employing high-priced artists as designers, and getting up new patterns, means a heavy outlay of money, and only the large makers can really do it; but there is no option in the matter. The public are most exacting, and demand new things and good ones, and a manufacturer who is content to rely upon his past good name soon falls to the rear. Nothing is more striking in all this change than the generally prevailing desire for harmony and adaptation. There are patterns and colors for every species of building, and to match every kind of wood. It is quite the fashion for the owners of public buildings to have designs made for them exclusively, they owning and paying for the patterns. Amid all this one good tendency is most manifest, the beginning, however crude, of an attempt to unite artistic ornamentation with industrial needs.

IRON WORKS IN RUSSIA.

TRADESMAN.

F. L. Garrison, of Philadelphia, some time since, visited the iron works of Count Stroganoff, at Dobransky, Perm, Russia. He also saw the iron works in the Eastern part of Finland,and gives an interesting description of these works in the Chicago *Journal of Commerce*. He says the furnaces in use, at the latter place, have double walls of soft iron plate, and are very effective. Favorable results are accomplished by the peculiar circulation of the blast through the hollow walls of the furnace and by the insertion of tuyeres into the hearth itself.

The walls of the furnace are of wrought iron plate, the whole being enveloped by a second wall or shell, extending from the hearth to the throat, thus forming a series of zones, divided by spiral partition, making a continuous spiral flue, coiled, as it were, around the furnace. The blast passing through this, is heated under ordinary circumstances from 150°-250° C. (302°-482° F.), though sometimes running up much higher. By means of a system of dampers and pipes, the circulation of the blast through these chambers or flues can be regulated with the greatest ease. If the blast is too hot, the upper and middle chambers are shut of; if, on the contrary, it is too cold, the upper chambers, which are frequently not used at all, are opened. This contrivance, together with the movable hearth, gives a most effectual control over the operation of the furnace. To check loss of heat by radiation, the outer shell is coated on the outside with a four-inch layer of fire-clay.

The other most important improvement made in the furnace was the insertion of the four tuyeres directly into the movable hearth. There are four tuyere holes in each of the two opposite sides of the hearth, the lower being three inches and the upper six inches from the bottom. When a fresh hearth has been inserted and a new loupe is begining to form, the tuyeres are inserted in the lower holer; as the loupe increases in size their inclination is lessened, the object being that the blast should just impinge upon the surfaces of the loupe. When the loupe has grown up nearly to the level of the lower tuyere holes the tuyeres are removed, placed in the upper holes, and the lower ones stopped with clay. The same operation is then repeated until the loupe reaches the level of the upper holes, when the tuyeres are taken out and the hearth is removed and replaced with a fresh one.

Thus the operation is practically continuous, the blast being stopped for about five minutes while the hearth is being replaced. The hearth stands upon a vertibally moving platform which can be raised and lowered a few inches, thus permitting a tight joint being made between the furnace proper and the hearth, the crack of about an inch between the two being first carefully luted with clay before the hearth and platform are raised. The slag is tapped off, into a car running under the hearth, by a series of four holes, one above the other. The hearth containing a fresh loupe, after being replaced by another, is revolved on the axis over the cast iron arms.

Sample of Alabama Booming.

One cannot help admiring the colossal scale on which everything is done in Birmingham. At Ensley, for instance, where the second largest pig iron plant in the United States is in operation, four big furnaces tower above you, and the men at the top look like Liliputians. The daily output of the four furnaces is 650 tons. It takes 400 cars per day to bring the ore, coke and limestone and carry off the iron. The slag is carried of, by the train load, in big kettles on trucks. The engines develop 3,500 horse-power, and it takes sixty-four 34-foot boilers—nearly a half mile of them—to run the plant, and 4,000,000 gallons of water are consumed daily. "The snorting of the blast among the big pipes is an awfully Plutonic sound. It makes you feel as if you were on the verge of the infernal regions." The last two sentences, in quotation marks, are from the pen of a Georgia reporter—he ought to be an authority!—[Col. H. W. Pinkney, in "Dixie."

Wide Awake for June might well be called a "true-story number." It opens with a reproduction of Henry Bacon's beautiful painting, "The End of a Long Day," photographed especially for *Wide Awake*—a lovely picture. Then come the true stories—five of them: "A Plain Case" is by the now famous writer, Miss Wilkins, who grew her early laurels in *Wide Awake*; this story is most pathetic. The scene of Miss Risley Seward's brilliant story is on board an ocean steamer; it is entitled "The Naughtiest Boy I Ever Met." Mrs. General Fremont's is a California story, "The House that Jack Built." Mrs. Annie Sawyer-Downs' story is of the Confederate side in the Civil War, a jolly tale, "The French Member of Company B." The story by Sara Trainer Smith, "Overboard in the Java Sea," will go to everybody's heart. The serials are excellent: Margaret Sidney's "Five Little Peppers Further On" has a tremendous surprise for readers; "Sibyl Fair's Fairness," by Talbot, will be enjoyed by *Wide Awake's* grown-up audience.

OHIO paper machinery makers are building paper mill machinery in Canada, Mexico and Australia.

THE STEEL RAIL MARKET.

Eastern mills report business, aggregating 13,000 tons at $26.50@$27. In the West only one small transaction, an addition to a larger order placed with a Pittsburgh mill lately, is reported. Prices there are still $26. The *Iron Age* divides the mills in the association into three groups, the Eastern with the Troy, Scranton, Lackawanna, Pennsylvania and Bethlehem; the Central with Edgar Thomson, Cambria and Cleveland, and the Western with North Chicago, Joliet, Union and Springfield, says the report of the Board of Control shows the following for the first four months:

Group.	Sales.	Allotment.
Eastern	300,995	383,537
Central	222,548	281,260
Western	226,521	288,306
Total	750,064	.....

The total allotment, which includes one mill not enumerated in the above, is 990,850. It should be noticed, however, that the total sales reported, 750,064, do not include the Allegheny Bessemer Co., whose sales aggregate at least 50,000 tons. Nor does it include the sales made since May 1. It is estimated that this will make the total 850,000 tons. On May 1, 1888, the sales had been about 721,000, while at the same date in 1887 they aggregated 1,598,048 tons. The shipments from the mills up to May 1 were 343,044 tons in 1889, against 299,556 tons in 1888, and 564,403 tons in 1887. It is said that there is an inquiry in the market for 40,000 tons of rails for an extension of the Chicago, Kansas & Nebraska.

Decoration Day Excursion.

The Nickel Plate will sell excursion tickets between all stations on the line at one fare for the round trip. Tickets good going May 29th and 30th, returning until May 31st, inclusive. One fare for the round trip.

A NEW fence is made of soft steel, cut while in the plate, and drawn out after the fashion of paper love baskets.

LIST OF PATENTS.

Relating to Iron, Steel, Metal, Machinery, Hardware and Mining Interests.

Reported expressly for this paper by H. T. Fisher, (late Ex. U. S. Patent Office), Patent Attorney, 34 Blackstone Building, Cleveland, O.

PATENTS BEARING DATE MAY 14, 1889.

Auger heads, die for forming, H. L. Shaler, Deep River, Conn.
Gold and silver from ores, obtaining, J. S. MacArthur, R. W. and W. Forrest, Glasgow, Scotland.
Grinding twist or flat drills, gauge for, A. F. Brewer, San Francisco, Cal.
Ore-washer, W. W. Rosensteel, Pittsburgh, Pa.
Ores, device for collecting metallic, H. H. Eames, Baltimore, Md.
Ores, reducing and separating magnetic, J. D. Cheever, New York, N. Y.
Rolling mill, J. Robertson, Birmingham, Eng.
Rolling mill feed table, J. Morgan, Oakleigh, Isle of Wight, Eng.
Roofing plate, metallic, G. Patten, Nashville, Tenn.
Roofing, sheet metal, F. G. Caldwell, Wheeling, W. Va.
Tuyere, forge, W. H. Shank, Huntington, Ind.
Welding and shaping of metals, electric, E. Thomson, Lynn, Mass.

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Steam and Hot Water.

10,000 pleased parties using an aggregate of over **12,500,000** square feet of Bundy Radiators attest to their superiority.

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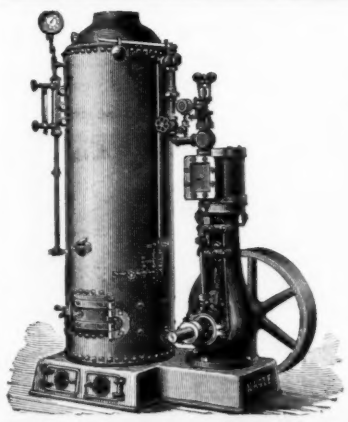

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IRON AND STEEL MARKETS.

PIG IRON.

CLEVELAND (f. o. b. cars, four months): Bessemer, $17 00@00 00; No. 1 Foundry, $15 65@16 15; No. 2 Foundry, $14 65@15 15; No. 1 Gray Forge, red short, $13 65@14 15; No. 2 Gray Forge, neutral, $13 15@13 65; No. 1 American Scotch, $16 90@17 55; No. 2 American Scotch, $15 90@16 55.

CHICAGO (reported by Rogers, Brown & Co.): CHARCOAL IRONS—L. S. Nos. 1 and 2 Foundry, $18 00@19 00. Southern C. C. Foundry, $17 00@13 00; H. R. C. C. Foundry, $20 00@23 00. COKE AND BITUMINOUS—Ohio H.R. Strong Softeners No. 1, $18 25@00 00; Ohio H. R. Strong Softeners No. 2, $17 25@00 00; Ohio Hocking Valley Strong Softeners No. 1, $17 75@00 00; Ohio Hocking Valley Strong Softeners No. 2, $16 75@00 00; Ohio Hocking Valley Silvery Softeners No. 1, $17 00@00 00; Ohio Hocking Valley Silvery Softeners No. 2, $16 00@00 00; Ohio Black Band Softeners No. 1, $18 00@18 50; Ohio Jackson Co. pure Softeners No. 1, $17 75@18 25; Ohio Jackson Co. pure Softeners No. 2, $16 75@17 75; Norton & Ashland Brands, Ashland, Ky., pure Softeners No. 1, $17 00@17 50; do. No. 2, $16 00@16 50; Southern Coke Foundry No. 1, $16 00@00 00; Southern Coke Foundry No. 2, $15 25@00 00; Southern Coke Foundry No. 3, $14 75@00 00; Southern Coke Softeners No. 1, $15 25@00 00; Southern Coke Softeners No. 2, $14 25@00 00; Southern Coke Grey Forge $13 75@14 00; No. 1 Foundry (local furnaces at Chicago and in Northwest) $15 50@16 00; No. 2 Foundry $14 50@15 00; No. 3 Foundry $13 50@14 00. CAR WHEEL AND MALLEABLE—Lake Superior Nos. 1 to 6, $18 50@19 50; Standard Southern Nos. 3 to 6, $19 00@19 50; Hanging Rock Cold Blast $23 50@26 00; Hanging Rock Warm Blast $21 00@23 00

CINCINNATI (reported by Rogers, Brown & Co.): HOT BLAST FOUNDRY—Ohio and Southern Coke No. 1, $14 75@15 25; Ohio and Southern Coke No. 2, $14 00@14 50; Ohio and Southern Coke No. 3, $13 25@13 75; Ohio Soft Stone Coal No. 1, $15 75@16 50; Ohio Soft Stone Coal No. 2, $14 75@15 50; Mahoning and Shenango Valley, $16 00@16 50; Hanging Rock Charcoal No. 1, $20 00@22 00; Hanging Rock Charcoal No. 2, $19 00@21 50; Tennessee and Alabamba Charcoal No. 1, $17 50@18 50; Tennessee and Alabama Charcoal No. 2, $16 50@17 50. FORGE—Strong Neutral Coke, $12 75@13 25; Mottled Neutral Coke, $12 00@12 50; Cold Short Coke, $12 75@13 00. CAR WHEEL AND MALLEABLE—Southern Car Wheel, $23 00@24 50; Hanging Rock Cold Blast, $22 00@25 00; Lake Superior Malleable and Car Wheel, $20 50@21 00.

LOUISVILLE (reported by Geo. H. Hull & Co.): Southern Coke No. 1 Foundry (new classification), $14 75@15 25; Southern Coke No. 2 Foundry (new classification), $14 25@14 75; Southern Coke No. 3 Foundry (new classification), $13 75@14 25; Grey Forge, $13 25@13 75; White and Mottled, different grades, $12 75@13 25; Silver Grey, different grades, $13 00@13 50; Southern Charcoal No. 1 Foundry, $16 25@16 75; Southern Charcoal No. 1 Mill, $14 75@15 25; Southern Car Wheel, Standard brands, $21 75@22 75; Southern Car Wheel, other brands, $18 00@19 50; Hanging Rock Coke No. 1 Foundry, $15 50@16 00; Hanging Rock Charcoal No. 1 Foundry, $19 50@21 00; Hanging Rock Cold Blast, $20 75@22 75; Hanging Rock Warm Blast, $00 00@00 00.

ST. LOUIS (reported by Rogers, Meacham & Shields): HOT BLAST COKE AND CHARCOAL—Southern Coke No. 1, $15 25@16 00; Southern Coke No. 2, $14 75@15 25; Southern Coke No. 3, $14 25@14 75; Southern Grey Forge, $13 25@13 75; Southern Charcoal No. 1, $18 00@18 50; Southern Charcoal No. 2, $17 00@18 00; Missouri Charcoal No. 1, $16 00@16 50; Missouri Charcoal No. 2, $15 00@16 00; Ohio Softeners, $17 00@19 00. CAR WHEEL AND MALLEABLE IRONS—Lake Superior, $19 75@22 00; Southern, $19 00@23 00. CONNELLSVILLE COKE—East St. Louis, $4 40; St. Louis, $4 55.

DETROIT (reported by William F. Jarvis & Co.): Lake Superior Charcoal, all Numbers, $19 50@20 00; Lake Superior Coke, all Ore, $18 00@19 00; Lake Superior Coke, Cinder Mixed, $17 75@18 25; Standard Ohio Black Band, $18 00@19 00; Southern No. 1, $17 00@17 50; Southern Gray Forge, $15 00@15 50; Southern Silvery, $16 00@16 50; Jackson County (Ohio) Silvery, $18 00@18 75; Old Wheels, $18 50@19 00.

PITTSBURGH (reported by A. H. Childs): No. 1 Foundry, $16 00@16 50; No. 2 Foundry, $15 00@15 50; No. 1 Mill, $14 25@14 50; White and Mottled, $13 00@13 50; Warm Blast Charcoal, $19 00@22 00; Cold Blast Charcoal, $22 00@28 00; Bessemer, $16 25@16 50.

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Flat Bar.

1½ to 4 by ¾ to 1 inch	1 70
4¼ to 6 by ⅜ to 1 inch	1 80
1¾ to 6 by 1⅛ to 2 inch	2 10
1¼ & 1⅜ by ⅜ to ¾ inch	1 80
1 & 1⅛ by ⅜ to ¾ inch	1 80
⅝, ¾ and ⅞ by ⅜ to ⅝ inch	2 20

Round and Square.

1 to 1⅞ inch	1 70
2 to 2⅝ inch	1 90
2¾ to 3¼ inch	2 20
3⅜ to 4 inch	2 70
4¼ to 4½ inch	3 20
4¾ to 5 inch	3 40

Oval.

⅜ to 1¼ inch	2 10
⅜ to ¾ inch	2 30
½	2 50
⅝	2 90

Half Oval and Half Round.

1½ to 3 inch	2 80
⅜ to 1¼ inch	2 40
⅜ to ¾ inch	2 90
½	3 20
⅝	4 70

Heavy Band.

½ to 6 by ¼ and 5-16 inch	1 95
1 to 1⅜ by ¼ and 5-16 inch	2 05
¼ to ⅞ by ¼ and 5-16 inch	2 25
½ to ⅞ by ¼ and 5-16 inch	2 75

Hoops.

1¼ to 4, Nos. 13 to 15	2 55
1¼ to 2, Nos. 16 to 18	2 65
1¼ to 2, No. 19	2 75
1¼ to 2, No. 20	2 85
1¼ to 2, No. 21	2 95
1¼ to 2, No. 22	3 05
15-16, 1 and 1⅛, Nos. 13 to 15	2 75
15-16, 1 and 1⅛, Nos. 16 to 18	2 85
15-16, 1 and 1⅛, Nos. 19 and 20	2 95
15-16, 1 and 1⅛, No. 21	3 05
15-16, 1 and 1⅛, No. 22	3 25
⅞, Nos. 13 to 15	2 95
⅞, Nos. 16 to 18	2 05
⅞, Nos. 19 and 20	2 15
⅞, No. 21	3 25
⅞, No. 22	3 35
13-16, Nos. 13 to 15	3 15
13-16, Nos. 16 to 18	3 25
13-16, Nos. 19 and 20	3 35
13-16, No. 21	3 45
13-16, No. 22	3 55
¾, Nos. 13 to 15	3 25
¾, Nos. 16 to 18	3 35
¾, Nos. 19 and 20	3 45
¾, No. 21	3 55
¾, No. 22	3 65
11-16, Nos. 13 to 15	3 45
11-16, Nos. 16 to 18	3 55
11-16, Nos. 19 and 20	3 65
11-16, No. 21	3 75
11-16, No. 22	3 85
⅝, Nos. 13 to 15	3 85
⅝, Nos 16 to 18	3 75
⅝, Nos. 19 and 20	3 95
⅝, No. 21	4 05
⅝, No. 22	4 15
⅝, No. 23	4 25

Light Band.

1½ to 6 by ⅛ to 3-16 in	2 25
1½ to 6 by Nos. 11 and 12	2 35
1 to 1¾ by ⅛ to 3-16 in	2 35
1 to 1⅜ by Nos. 11 and 12	2 45
⅞ and 13-16 by ⅛ to 3-16 in	2 65
⅞ and 13-16 by Nos. 11 and 12	2 75
¾ and 11-16 by ⅛ to 3-16 in	2 95
¾ and 11-16 by Nos. 11 and 12	3 05
⅝ and 9-16 by ⅛ to 3-16 in.	3 25
⅝ and 9-16 by Nos. 11 and 12	3 30
½ by ⅜ to 3-16 in	3 50
½ by Nos. 11 and 12	3 60

Wagon Box Iron.

⅞ inch, beveled edge, by Nos. 11 and 12	2 75
⅞ inch, " " " 13 and 14	3 05
¾ inch, " " " 11 and 12	3 05
¾ inch, " " " 13 and 14	3 25

Sheet Iron.

No. 10 to 14	2 50
No. 15 to 17	2 70
No. 18 to 21	2 80
No. 22 to 24	2 90
No. 25 to 26	3 00
No. 27	3 10
No. 28	3 30

Iron Boiler Plates.

Tank, ¼ inch and heavier	2 35
C No. 1, " "	2 60
C H No. 1 " "	2 85
C H Flange, " "	3 55
Extra Flange, " "	3 95
Solid Fire Box, "	4 85

Steel Boiler Plates—1-4 in. and Heavier.

Tank	2 55
Shell	2 95
Flange	3 20
Marine Flange	3 70
Fire Box	4 35

Above includes plates 90 inches wide.

90 to 96 in. wide	½c ℔ extra
96 to 100 in. wide	1 c "
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1 to 2 in. inclusive	09
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3⅛ to 4 in	11
⅝ to 11-16 and 4⅛	10½
⅛ to 6 in	11½
¼ to 9-32 and 6⅛ to 7 in	12
3-6 in	14

Flats.

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2 to 9-16 wide by 2 to ⅝ thick	0

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Tire	" 02¾
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Iron axles	24 00
Light sheet iron	10 00
Axle turnings	14 00
Wrought turning (free from cast)	12 50
Wrought iron, oily drillings	11 00
Cast borings	9 00
Malleable iron	10 00
Uncut wrought iron boilers	10 00
Steel boiler plates	14 50
Old iron T rails	gross tons 22 00
Old steel rails	18 50
Car wheels	20 00
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Light yellow brass	6
Scrap Zinc	
Tea Lead	
Heavy Lead	3¼

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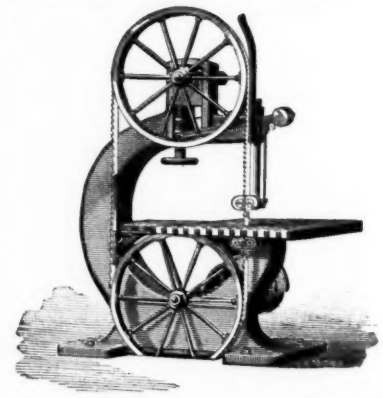

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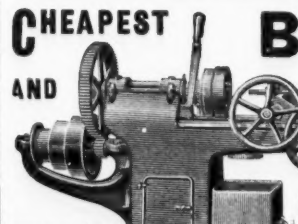
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American ..... ℔ lb 9@10
Wrights ..... ℔ lb 9½

Bellows.

Blacksmiths' { Hill's ..... dis 40
Blacksmiths' { Bullock's .... dis 50&10
Moulders' ..... dis 40@40&10
Hand ..... dis 40&10@50

Belting.

Boston Belting Co's standard ..... dis 70@70& 5
" " " extra ..... dis 60&5@60&10
" " " best ..... dis 55
Hoyt's Short Lap ..... dis 45
Cleveland Rubber Co. extra standard dis 60&10
Shultz Raw Hide Leather Belting, single, ... dis 30
Shultz Raw Hide Leather Belting, double, ... dis 35
Standard, oak tanned ..... dis 55@60
Alexander Brothers' pure oak tanned. ... dis 45

Blowers and Exhausters.

B. F. Sturtevant's ..... dis 20
Boston Blower Co., ... dis 35
Buffalo ..... dis 35

Borax.

..... ℔ lb 9½@10½

Chalk.

White ..... ℔ gross 50
White Crayon ..... ℔ gross 12@12½ dis 10
Red ..... dis 70
Blue ..... dis 85

Chucks.

Cushman's 4 Jaw Independent ..... dis 40
" Combination ..... dis 40
" Geared Scroll ..... dis 30
" 2 Jaw Brass Workers. ..... dis 25
" Drill ..... dis 35
Wescott's Scroll Combination ..... dis 30
" Independent ..... dis 40
" Little Grant Drill ..... dis 30
Horton's Universal & Ind ..... dis 40
National Combination ..... dis 40
Sweetland " ..... dis 40
Skinner " ..... dis 40
" Independent ..... dis 40
Almond Drill ..... dis 25
Morse " ..... dis 15
Skinner " ..... dis 30

Cutters and Reamers.

Cleveland ..... dis 10@15
Pratt & Whitney ..... dis 10@15
Standard ..... dis 10@15
Brown & Sharpe, Milling Cutters ..... dis 15
" " Gear Cutters. ..... dis 15

Crowbars.

Cast Steel ..... ℔ lb 4
Iron, steel points ..... ℔ lb 3½

Drill and Drill Stocks.

Twist drills ..... dis 50&10
Morse Taper and Straight shank to 1½" ..... dis 50&10
Morse Taper and Straight shank Larger than 1½" ..... dis 25
Drill Sockets ..... dis 20
Standard ..... dis 50&10
Cleveland ..... dis 50&10

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. FF.
Kegs, ℔ lb	4 c	5 c	2½c	
½ kegs ℔ lb	4¼c	5¼c	2¾c	
¼ kegs ℔ lb	4½c	5½c	3 c	
10 lb cans, 10 in case	6 c	6½c	5 c	
10 lb cans, less than 10	10 c	10 c	7½c	

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 40@46
H. H. Barton ..... dis 40@46

Emery Wheels.

Detroit ..... dis 50@60
Norton's ..... dis 55@60
Grant ..... dis 55@60
Union Stone ..... dis 60
Sterling ..... dis 60
Vulcanite ..... dis 15@20
Celluloid ..... dis 10
Northampton ..... dis 55
Crystal ..... dis 65@70
Vitrified ..... dis 60

Files.

Nicholson ..... dis 60&10@60&10&10
" X. F ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
Arcade ..... dis 65@70
Disston's ..... dis 65@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1887 ..... dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list ..... dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3¾	3½
Hexagon	15½	11½	8½	6	5¾	5¼	5
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ℔ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887 ..... dis 70 &10
Standard Penny Nails, ℔ keg card rate
{ Car lots $2.50
{ Less than car lots $2.60

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ℔ doz ..... dis 10@10&10

Packing, Steam.

Boston Belting Co ..... dis 60
American Packing Hemp ..... ℔ lb 10@11
Russia Packing " ..... ℔ lb 14
Italian Packing " ..... ℔ lb 13@14
Plumbago Piston ..... ℔ lb 40
Morrison's " ..... ℔ lb 50
Square Flax " ..... ℔ lb 70
Sheet Rubber ..... ℔ lb 12@24
Excelsior Rubber ..... ℔ lb 48

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60&5@60&10
" 6 to 7 lbs ..... $13 dis 60&5@60&10

Pulleys.

Iron Pulleys, Walker List ..... dis 45
Medart Pulleys ..... dis 55
Split Wood Pulleys ..... dis 45

Rivets.

Iron, Thousand, list November 17, ... dis 50@50&10
Iron, Ordinary, Cooper's Block and Carriage list November 17 ..... dis 50
Copper ..... dis 50@50&10

Rope.

Manilla, ½ inch and over ..... ℔ lb 15¼
Sisal, ½ inch and over ..... ℔ lb 13¼

Sand Paper.

B. A. & Co ..... dis 40@40&10
H. H. Barton's ..... dis 40@40&10
New England Flint ..... dis 40@40&10
Barton's Garnet ..... dis 20

Saws.

Disston's Circular ..... dis 45
" Band ..... dis 20
" Scroll ..... Net
Hack Saw Stubs ..... dis 20
" " Eureka ..... dis 20
" " Star ..... dis 20
Saw Swages Disston's ..... dis 20
Atkins' Cicular Saws ..... dis 50
" Mill, Mulay and Drag Saws. dis 40&10
" Wood Saws ..... dis 40&10
" Silver Steel Diamond Cross-cut Saws ..... dis 70c per ft
" Dexter Cross-cuts ..... dis 50c "
" Diamond " ..... dis 30c "
" Tuttle Tooth Cross-cuts. dis 25c "
" One-man Cross-cuts ..... dis 32c "
No. 1 Handles ..... dis 23c per pair
No. 6 " ..... dis 16c "
Excelsior Saw Tools ..... $6 per doz
Perfection " ..... $15 "

Screws.

Wood Screws—List Jan 27, 1889.
Flat head iron ..... dis 50
Round head iron ..... dis 40
Flat head brass ..... dis 45
Round head brass ..... dis 35
Square Cap ..... dis 65
Hexagon Cap ..... dis 60
Set C. H. C. P ..... dis 70
Machine, flat head, iron ..... dis 55
Machine, round head, iron ..... dis 50
Bench and hand—
Lag or coach ..... dis 75@75&10
Coach, patent gimlet point ..... dis 75

Shovels and Spades.

Ames' list November 1, 1885 ..... dis 20
Dennis ..... dis 5.25
Hussey & Binns, railroad ..... dis 8.00

Taps.

Cards, Hand and Nut to 2 in ..... dis 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " ..... dis 25
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 50
Pulley Taps ..... dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls	21c@29c	
No. 18 " " ¼ and ½ "	18c@28c	
No. 36 " " ¼ and ½ "	16c@27c	
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)	11½c	
3-Ply " 1 lb Balls	12@12¼c	
3-Ply " 1½ lb Balls	11@11¼c	

Cotton Wrapping, 5 Balls to lb ..... 15@16c

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 10@15
Howard ..... dis 30

Wire.

New List, Jan. 18, 1884

Brass and copper ..... dis 20@25
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75& 5
" " Nos. 27@36 ..... dis 75&10& 5
Coppered Nos. 0 to 18, market list ..... dis 70@70& 5
Galvanized Nos. 0 to 18 " " ..... dis 65&5
Tinned market Nos. 0 to 18 ..... dis 67½
Cast steel ..... dis 50
Tinned Broom Wire ..... dis 70&5@70&10
Annealed Fence, Nos. 8 and 9 ..... dis 75
Annealed Grape, Nos. 10 to 14 ..... dis 75
Stub's Steel Wire regular ..... $6.00@lb dis 30

Wrenches.

Coe's genuine, cash in ten days ..... dis 50
Girard Standard ..... dis 70&10
Agricultural ..... dis 75&10
Mechanics' ..... dis 55&10,& 3
Bemis & Call's Combination ..... dis 35
Donohue's Engineers ..... dis 20&10
Lamson & Sessions Engineers ..... dis 60
Billings & Spencer's Drop Forged ..... dis 10
William's " " ..... dis 10
Alligator " " ..... dis 40

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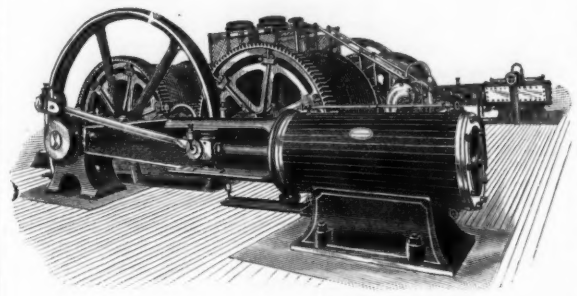

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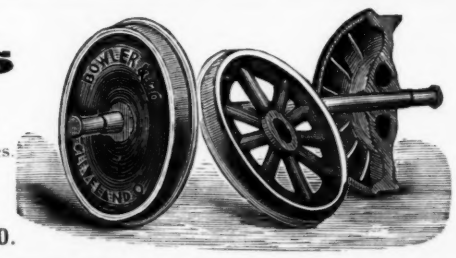

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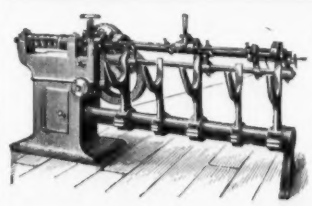

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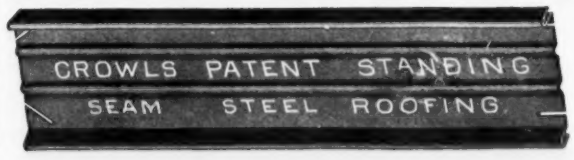

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ommon augers and bits.....dis 70
nell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $2 75@3 25
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔dox. $6 00@6 50
Others.....℔doz. $5 50@5 75
Full polished.....$8 00

Bolts.

Cast iron barrel bolts.....dis 70@70&10
Cast iron shutter bolts, etc.....dis 70@70&10
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70@70&10
Wrought iron square bolts.....dis 70@70&10
Wrought shutter bolts.....dis 60&10
Carriage, common, new list.....Sargent's list
Tire, common, new list.....dis 75&10
Carriage and tire, Philadelphia pattern.....dis 70
Stove bolts.....dis 75&10
Plow bolts.....dis 62½
Machine.....dis 60&5
Ends.....dis 75&10&80

Buckets, Elevator.

.....dis 75&10&80

Butts.

.....dis 50&10

Wrought brass.....dis 70@70&10
Cast brass, loose joint.....dis 33⅓&10
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60&5
Fast joint, broad.....dis 55&10&5@60&10
Loose joint.....dis 70&10@75
Loose joint, jap.....dis 70&10@75
Loose joint, jap. with acorns.....dis 70&10@75
Loose pin, acorns.....dis 70&10@75
Loose pin, japanned acorns.....dis 70&10@75
Loose pin, acorns, jap. plated tips..dis 70&10@75
Wrought steel—
Wrought, fast joint, narrow.....dis 70&10@75
Wrought, fast joint, broad.....dis 70&10@75
Wrought, loose joint, broad.....dis 70&10@75
Table Butts, back flaps, etc.....dis 70&10@75
Regular inside blind.....dis 70&10@75
Light inside blind.....dis 70&10@75
Loose pin.....dis 70&10@75
Light loose pin.....dis 70&10@75

Chains.

Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 } 50&10@50&10&5
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887..dis 50&10&5@60
Galvanized Pump Chain.....℔ 15½@16
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 70@70&5

Chisels.

Socket Framing and Firmer.....dis 75&5@75&10
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hangers.

Barn door, old patterns.....dis 10&10@70
Climax, (Anti-Friction).....dis 70
Star.....dis 40&10@40&10&5
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 40&10
Richard's.....dis 30@30&10

Horse Nails.

	No.	10	9	8	7	6	
Ausable,	℔ lb.	23	24	25	26	28	dis 25&10@25&10&10
Putnam,	℔ lb.	18	19	20	21	23	dis 15
Essex							dis 25&10@25&10&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hemacite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbear, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 66⅔
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps,genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs. genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 66⅔
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓

Plumbs and Levels.

Standard list.....dis 70&10@70&10&10
Pocket levels.....dis 70&10@70&10&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout,best makers.dis 60&10@60&10&10
Pitcher spout,cheaper goods dis 70&5@70&10&5

Rakes.

Cast steel.....dis 65
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@[illegible]...dis 10
Rifle razor.....dis $9 50 net

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ dox $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron.....
Nickel plated.....} dis 75&10@80
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, January 2, 1888.

American iron carpet tacks all kinds.....dis 80@80&5
Steel carpet tacks all kinds.....dis 80@80&5
Swedes iron carpet tacks, all kinds.....dis 80@80&5
Swedes iron tacks.....dis 75&5@75&10
Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
Tinned Swedes iron tacks..dis 75&10@75&10&5
Tinned Swedes iron Upholsterers' tacks.....dis 75&10@75&10&5
American iron cut tacks.....dis 75@75&10
Copper tacks.....dis 50&10
Copper finishing and trunk nails.....dis 50&10
Cigar box nails.....dis 50&10@50&10&5
Finishing nails.....dis 70&10@70&10&10
Hungarian nails and miners' tacks.....dis 70&10@70&10&10
Gimp and lace tacks.....dis 75&10@75&10&5
" " " tinned.dis 75&10@75&10&5
Trunk and clout nails.....dis 70&10@70&10&10
Tinned trunk&clout nails.dis 70&10@70&10&10
Basket nails.....dis 70&10@70&10&10
Chair nails.....dis 70&10@70&10&10
Common and patent brads.dis 70&10@70&10&10
Tinned capped trunk n'ls..dis 70&10@70&10&10

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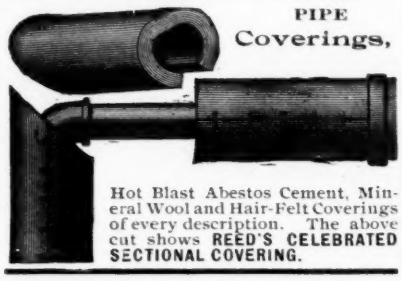

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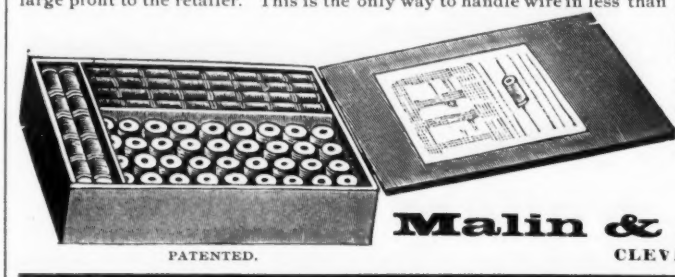

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Cheapest, most Reliable and most durable Burglar Alarms on the Market.
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LATEST IMPROVED
FOLDED LOCK SEAM
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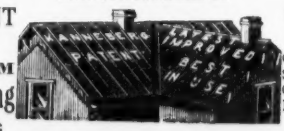

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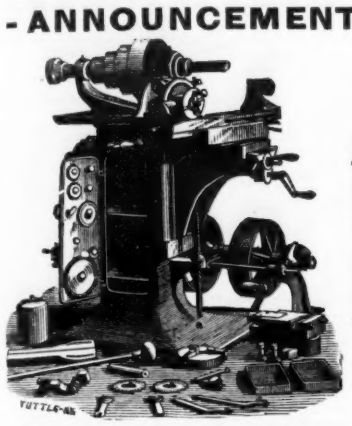

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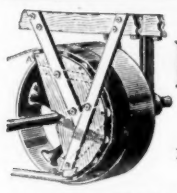

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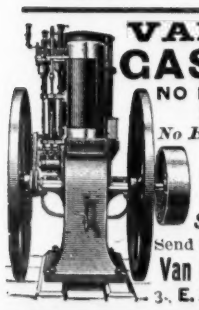

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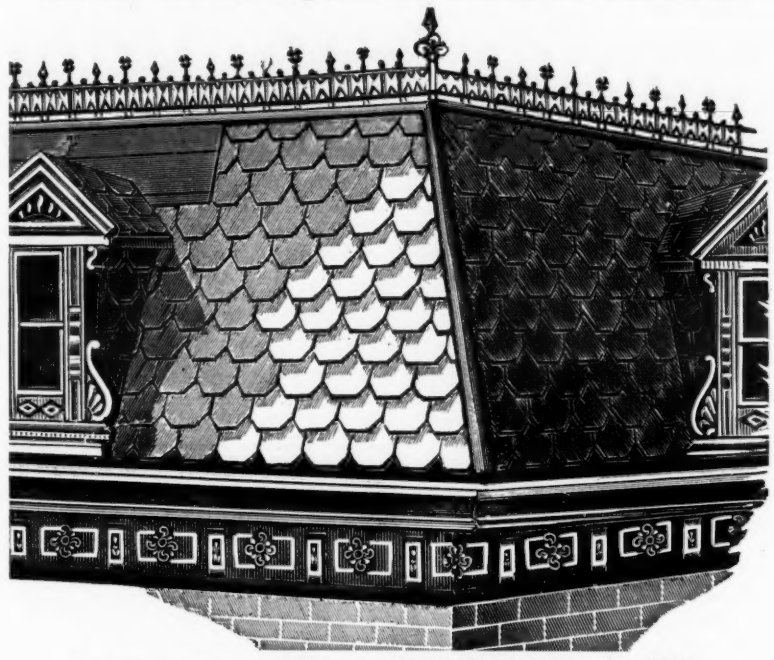

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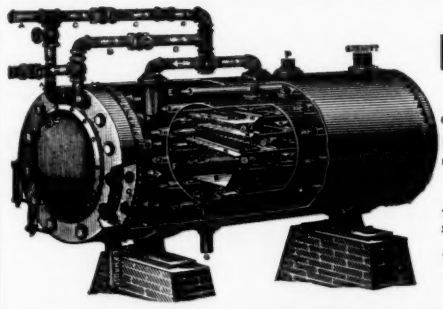

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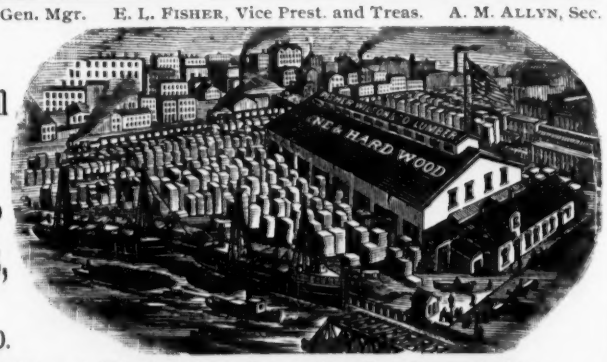

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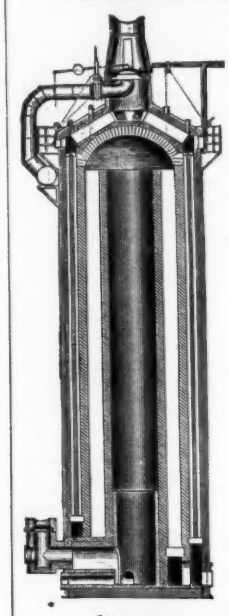

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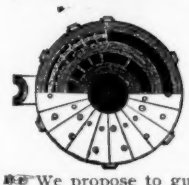

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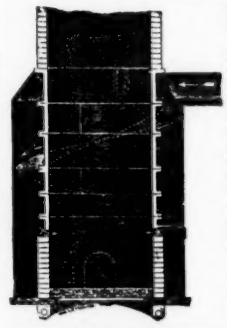

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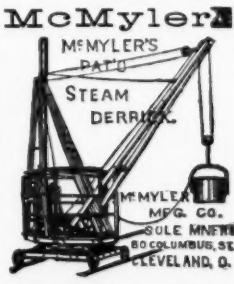

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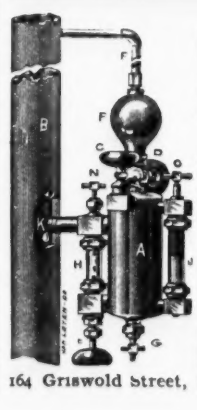

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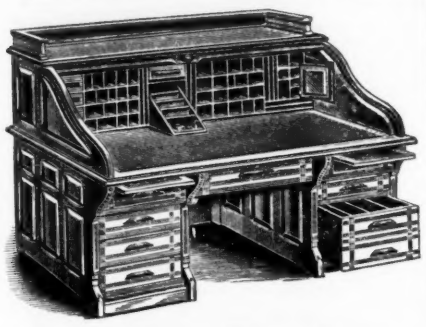

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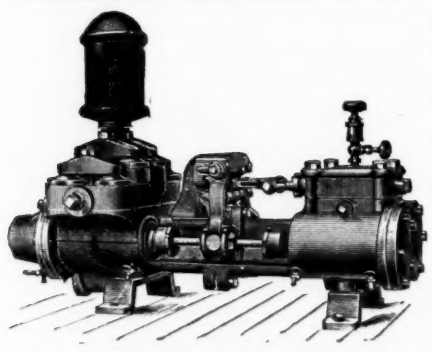

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Standard Time.
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Eastward.	Arrive.	Depart.
Buffalo Passenger	10 40 a m	10 45 a m
Chicago Passenger	9 20 p m	.....
Local Freight	4 40 p m	7 30 a m
Westward.	**Arrive.**	**Depart.**
Chicago Passenger	.....	6.30 a m
Fostoria Passenger	5 06 p m	5 11 p m
Local Freight	1 00 p m	5 50 a m

Rocky River Accommodation departs 7:40 a. m.; 1:40 p. m.

Euclid Accommodation departs 6:24 a. m.; 5.05 p. m.

All trains daily, except Sunday.

Cleveland & Pittsburgh.

	Arrive.	Depart.
New York Express	12 50 p m	7 45 a m
New York Express	6 35 p m	1 05 p m
Alliance & Akron Accom	9 35 a m	3 25 p m
Ravenna Accommodation	8 25 a m	5 00 p m
Night Express	*5 25 a m	*11 10 p m

*Daily; all other trains daily, except Sunday.

Mt. Vernon & Pan Handle Route.

C., A. & C. Ry. Co.	Arrive.	Depart.
Akron, Col. & Cin. "Flyer"	5 40 p m	8 10 a m
Akron, Col. & Cin. Night Express	7 00 a m	8 00 a m
Akron, Col. & Zanesv'e Ex	12 50 p m	1 95 p m
Akron & Orrville Accom	9 35 a m	3 25 p m

The 8 p. m. train runs daily. Elegant Pullman palace sleeping cars attached. All other trains daily, except Sunday.

Erie Railway.

Depot, South Water Street and Viaduct.

	Arrive.	Depart.
N. Y. & Pitts. Express	‡5 38 a m	*8 25 a m
Fast N. Y. & Pitts. Express	*10 55 a m	*3 00 p m
Mahoning Accommo		†6 40 a m
Pittsburgh Express	†6 25 p m	
Youngstown Local	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom		†4 30 p m
Pittsburgh Express	†1 20 p m	11 10 p m
New York Express	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.

Depart—
Canton and Coshocton—7:30 a. m., 4:05 p. m.
Bedford—7:30 a. m., *9:00 a. m., 11:10 a. m., 2:00 p. m., 4:05 p. m., 5:45 p. m., *8:15 p. m.
Newburgh—6:10 a. m., 7:30 a. m., *9:00 a. m., 11:10 a. m., 2.00 p. m., 4:05 p. m., 5:45 p. m., *8:15 p. m.
Kent—7:30 a. m., *9:00 a. m., 4:05 p. m., *8:15 p. m.
Arrive from—
Canton and Coshocton—9:50 a. m., 6:25 p. m.
Bedford—6:00 a. m., *7:40 a. m., 9:50 a. m., 1:05 p. m., 4:15 p. m., 6:25 p. m., *7:15 p. m.
Newburgh—6:00 a. m., 7:10 a. m., *7:40 a. m., 9:50 a. m., 1.05 p. m., 4:15 p. m., 5:35 p. m., 6:25 p. m., *7:15 p. m.
Kent—*7:40 a. m., 9:50 a. m., 6:25 p. m., *7:15 p. m.

Theatre train leaves Cleveland every Saturday night for Newburgh and Bedford 10:35 p. m.

Trains marked with * run daily. All others daily, except Sunday.

Depot at Ontario St., opposite Huron St.

Valley Railway.

FOR AKRON, CANTON AND MARIETTA

Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail	*7 45 a m	*6 30 p m
Marietta Express	†11 15 a m	†2 30 p m
Valley Junction Express	*4 15 p m	*10 15 a m
Cleve. and Canton Express	*7 00 p m	†8 15 a m

*Daily. †Daily, except Sunday.

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Cleveland, Lorain and Wheeling.

All trains arrive and leave the Union Depot as follows:

	Depart.	Arrive.
Wheeling Express	6 45 a m	6 55 p m
Uhrichsville Express	4 00 p m	9 20 a m

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	Depart.
No. 62, Accommodation	† 6 00 a m
No. 72, New York Express	* 8 30 a m
No. 72, Fast Pittsburgh Express	* 8 30 a m
No. 64, Fast Pittsburgh Express	* 3 00 p m
No. 66, Mantua Accommo	* 4 20 p m
No. 68, Pittsburgh Express	†10 50 p m
No. 68, New York Express	†10 50 p m
No. 70, Pittsburgh Local Express	†11 40 a m
No. 74, Youngstown Express	† 4 20 p m
	Arrive.
No. 65, Fast New York Express	*12 50 p m
No. 61, Pittsburgh Express	* 7 35 a m
No. 67, Pittsburgh Express	†10 55 a m
No. 63, New York Express	* 6 50 p m
No. 63, Pittsburgh Express	* 6 50 p m
No. 69, Pittsburgh Local Express	† 9 00 p m
No. 73, Accommodation	† 7 25 p m

*Daily. †Daily, except Sunday.

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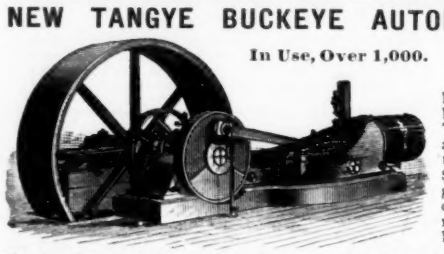

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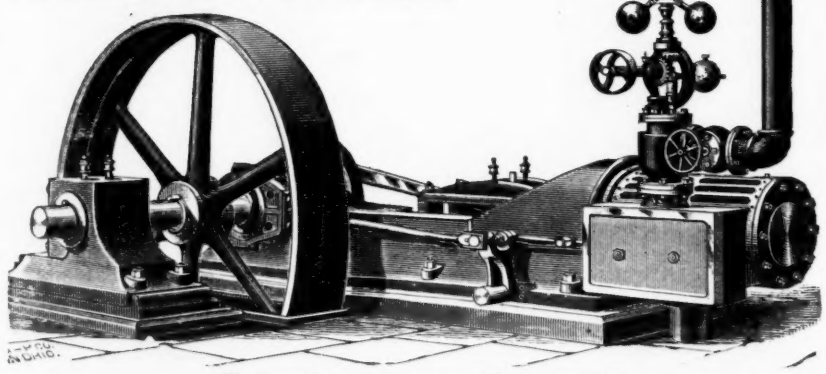

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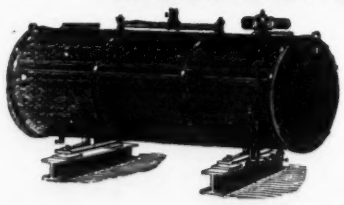

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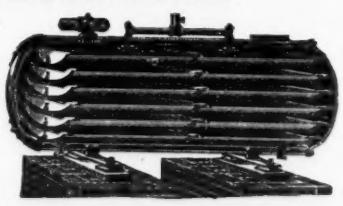

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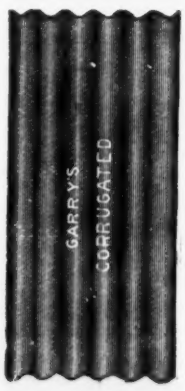

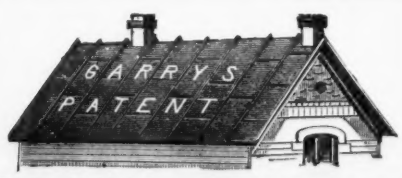

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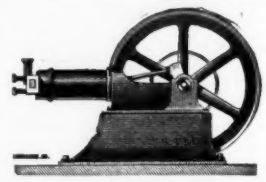

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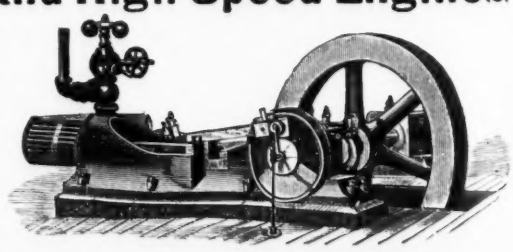

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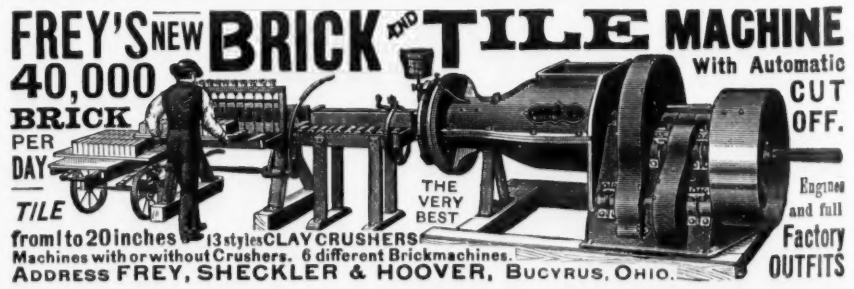

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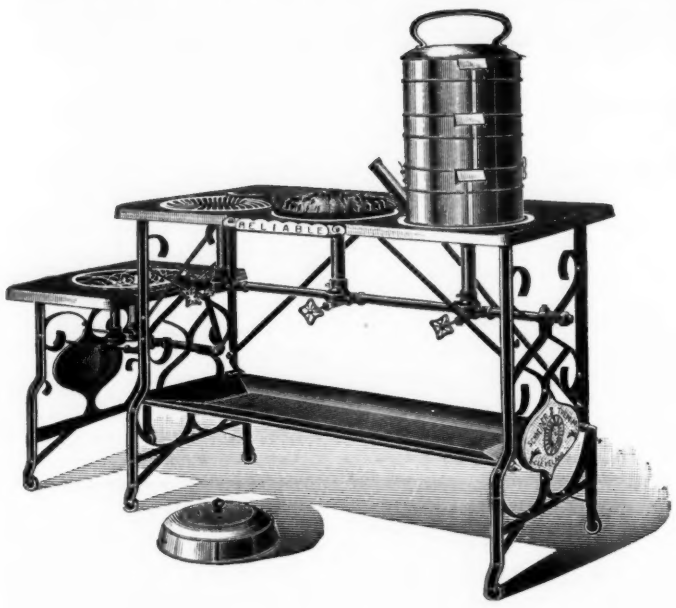

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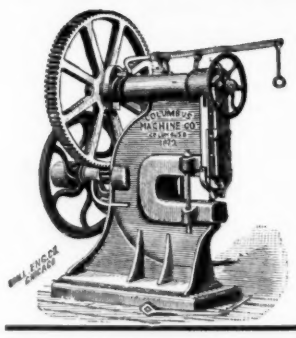

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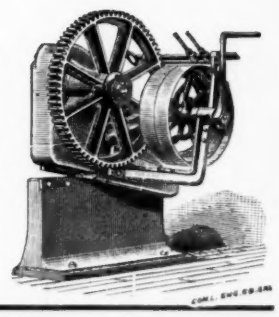

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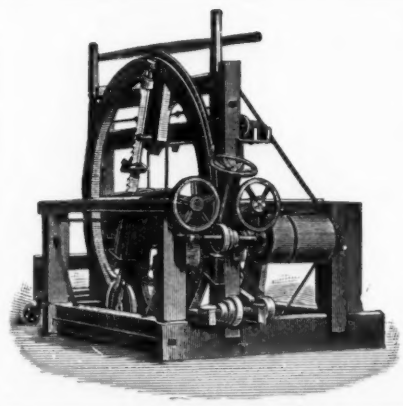

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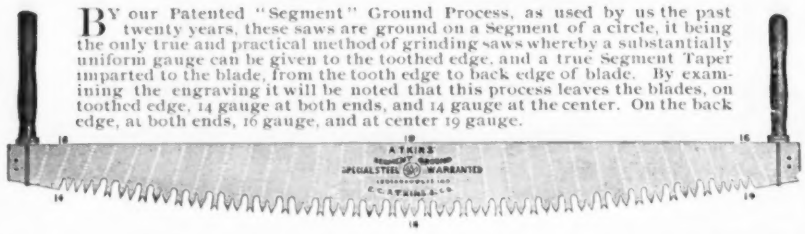

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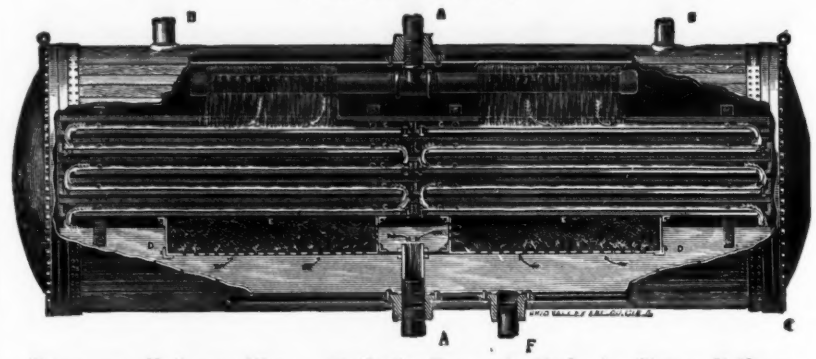

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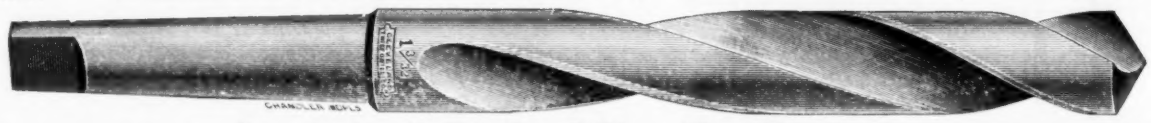

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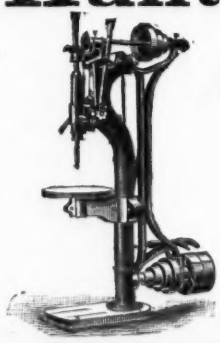

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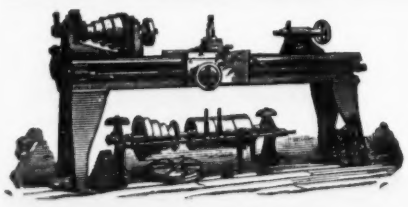

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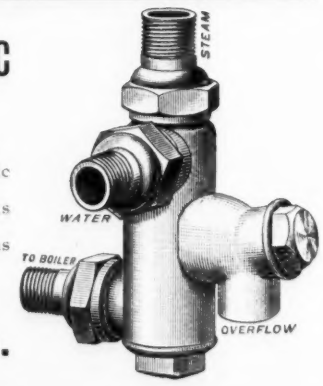

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